



NATIONAL BOARD FOR TECHNICAL EDUCATION

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

NATIONAL DIPLOMA

IN

HORTICULTURAL 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.

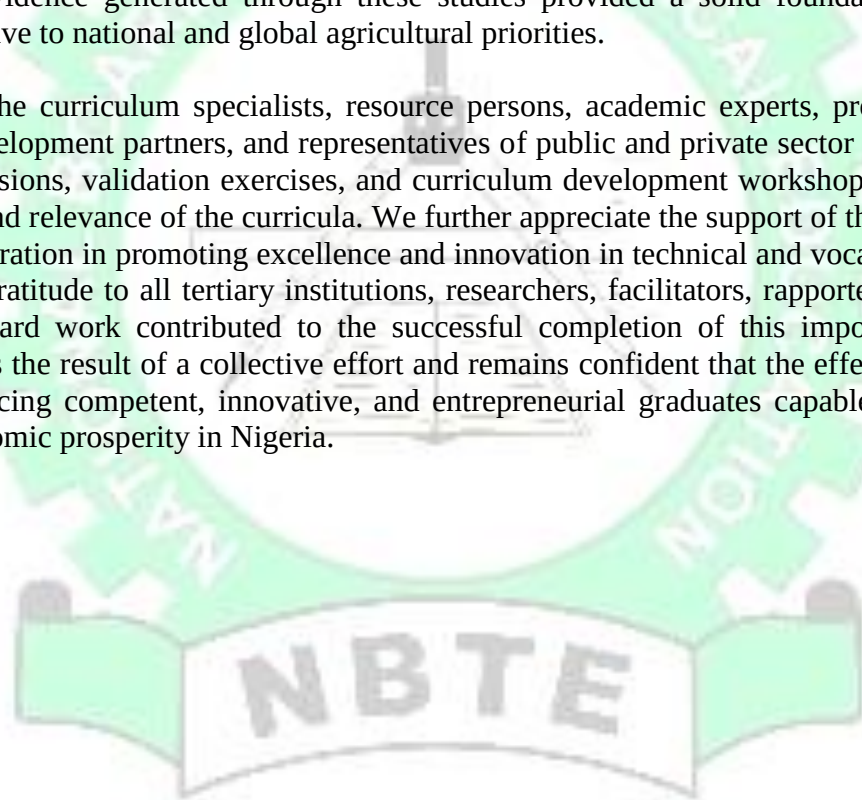
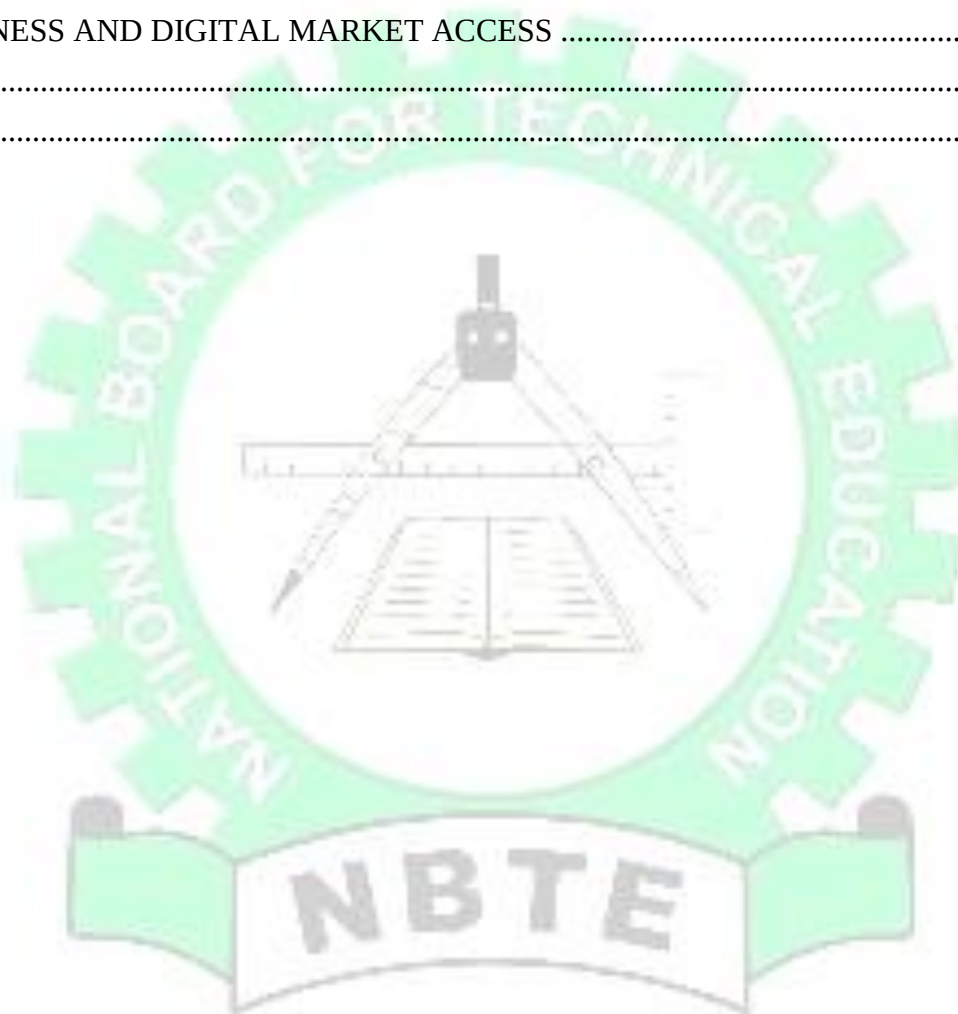


TABLE OF CONTENTS

PREFACE	ii
ACKNOWLEDGEMENT	iii
GENERAL INFORMATION	vi
CURRICULUM TABLE	xii
YEAR I SEMESTER I	1
PRINCIPLES OF HORTICULTURAL CROP PRODUCTION	2
NURSERY ENTERPRISE AND PLANT PROPAGATION SYSTEMS	13
SOIL AND PLANT NUTRITION FOR HORTICULTURE	22
VEGETABLE CROP PRODUCTION I	32
FRUIT CROP PRODUCTION I	41
YEAR I SEMESTER II	53
VEGETABLE CROP PRODUCTION II	54
IRRIGATION AND WATER MANAGEMENT IN HORTICULTURE	65
PEST AND DISEASE MANAGEMENT IN HORTICULTURE	75
PROTECTED HORTICULTURAL CROP PRODUCTION	84
FIELD PRACTICAL I (HORTICULTURAL PRODUCTION SYSTEMS)	98
CLIMATE-SMART AND PRECISION HORTICULTURAL PRODUCTION	105
ORNAMENTAL HORTICULTURE AND LANDSCAPING	117
YEAR II SEMESTER I	126
HORTICULTURAL CROP PHYSIOLOGY	127
HORTICULTURAL BUSINESS MANAGEMENT	138
FIELD PRACTICAL II (CONTROLLED PRODUCTION SYSTEMS)	148
POST-HARVEST HANDLING OF HORTICULTURAL CROPS	154
FRUIT CROP PRODUCTION II	164
YEAR II SEMESTER II	181

POST-HARVEST TECHNOLOGY AND VALUE ADDITION	182
EXPORT STANDARDS AND FOOD SAFETY COMPLIANCE	192
LANDSCAPING DESIGN AND URBAN HORTICULTURE	203
HORTICULTURAL AGRIBUSINESS AND DIGITAL MARKET ACCESS	211
LIST OF MINIMUM EQUIPMENT	222
LIST OF PARTICIPANTS.....	232



GENERAL INFORMATION

1. PROGRAMME NOMENCLATURE

National Diploma in Horticultural Technology

2. PROGRAMME GOAL

The National Diploma in Horticultural Technology programme is designed to produce competent horticultural technicians who are skilled, self-reliant and capable of applying modern techniques in horticultural crop production, controlled environment agriculture (greenhouses, hydroponics and vertical farming), post-harvest management, food safety and export compliance, digital marketing, and agribusiness enterprise.

3. OBJECTIVES OF THE PROGRAMME

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

- i. Establish and manage horticultural farm enterprises for vegetable, fruit and ornamental crop production.
- ii. Apply modern techniques in the production, propagation and nursery management of horticultural crops.
- iii. Operate controlled environment agriculture systems including greenhouses, hydroponics and vertical farms.
- iv. Apply irrigation and water management practices in horticultural production.
- v. Implement integrated pest and disease management programmes in horticultural enterprises.
- vi. Carry out post-harvest handling, value addition and marketing of horticultural produce.
- vii. Apply export food safety standards and compliance requirements to meet international market demands.
- viii. Use digital marketing and agribusiness e-commerce platforms to promote and sell horticultural produce.
- ix. Carry out ornamental gardening, landscaping and urban horticultural operations.
- x. Apply basic horticultural business management and entrepreneurship skills in setting up and running horticultural enterprises.

4. ENTRY REQUIREMENTS

The minimum entry requirements into the ND Horticultural Technology programme are:

- i. Four (4) O' Level credits in the West African Senior School Certificate (WASSCE), General Certificate of Education (GCE) Ordinary Level, Senior Secondary School Certificate (SSSC) or National Business and Technical Examination Board (NABTEB) in relevant subjects including Biology or Agricultural Science, Chemistry and any two of the following: Geography, Mathematics, Economics, Technical Drawing, Physics and English Language in not more than two sittings. And pass in English Language is compulsory

- ii. Evidence of Registration with Joint Admission and Matriculation Board

5. STRUCTURE/DURATION OF THE PROGRAMME

The National Diploma in Horticultural Technology is a two-year programme of four semesters of classroom, laboratory, field and workshop activities in the institution. Each semester shall be for 17 weeks, made up as follows:

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

6. CURRICULUM

The syllabus for the ND Horticultural Technology programme consists of four (4) main components. These are:

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

7. ACCREDITATION

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

8. CONDITIONS FOR THE AWARD OF ND HORTICULTURAL TECHNOLOGY

Institutions offering this programme will award the National Diploma to candidates who successfully complete the programme after passing prescribed course work, examinations, diploma project and the Students' Industrial Work Experience Scheme (SIWES). Such candidates should have completed a minimum of 72 and 80 semester credit units.

9. GRADING OF COURSES:

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

National Diploma Certificates shall be awarded based on the following classifications:

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

10. STAFFING REQUIREMENT

i. Core Teaching Staff

- A minimum of four (4) Core teaching staff who should possess at least a HND or B.Sc./M.Sc./PhD in Horticultural Technology, Agriculture or related discipline.
- Teaching staff that will teach newly introduced courses such as Controlled Environment Agriculture, Hydroponics, Digital Marketing, Global Good Agricultural Practices should acquire relevant training from recognized professional bodies and institutions before or within twelve months of the implementation of this curriculum.

Technical Staff

There shall be a Technologist, Technician and an Assistant in each training facility.

- The Technologist should possess a minimum of – HND in Horticulture, Crop Production, Forestry or related field.
- Technician should possess – ND in Horticulture, Crop Production, Forestry or related field.
- Farm Assistant should possess – SSCE or Certificate in any of the field mentioned above or related discipline.

There shall be a Technologist, Technician and an Assistant in each training facility.

ii. Headship of the Department (HOD)

The Head of Department shall possess at least HND/first degree and a higher degree in Horticulture or related field. He or she shall be of the rank of a Senior Lecturer or above and must be registered with a relevant Professional Body(s).

11. GUIDANCE NOTES FOR TEACHERS OF THE PROGRAMME

- The curriculum is drawn in unit courses in keeping with the provisions of the National Policy on Education, which stresses the need to introduce the semester credit unit system.
- In designing the units, the principle of the modular system by product has been adopted, thus making each professional module, when completed, provide the student with technician operative skills which can be used for employment purposes.
- The teaching of theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in professional courses and field work, should not be taught in isolation from the theory. All professional HOT courses are delivered at 70% practical and 30% theory.
- Where drones are available, lecturers are encouraged to incorporate drone-based aerial observation of horticultural plots into relevant practical sessions. Smart phones and digital tools should be integrated into practicals wherever applicable.

12. PRACTICAL LOGBOOK

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

13. FINAL PROJECT

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

14. GUIDELINES ON SIWES PROGRAMME

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

Responsibility for placement of Students.

- a. Institution offering the ND programme shall arrange to place the students in industry. By the end of second semester of the first academic session, six copies of the master list showing where each student has been placed shall be submitted to the Executive Secretary, NBTE,

who shall, in turn authenticate the list and forward it to the Industrial Training Fund, Jos. The Placement Officer should discuss and agree with industry on the following

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

Evaluation of Student during the SIWES

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

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

Grading of SIWES

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

The Institution based Supervisor

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

Frequency of visit

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

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

Stipend for Students in SIWES

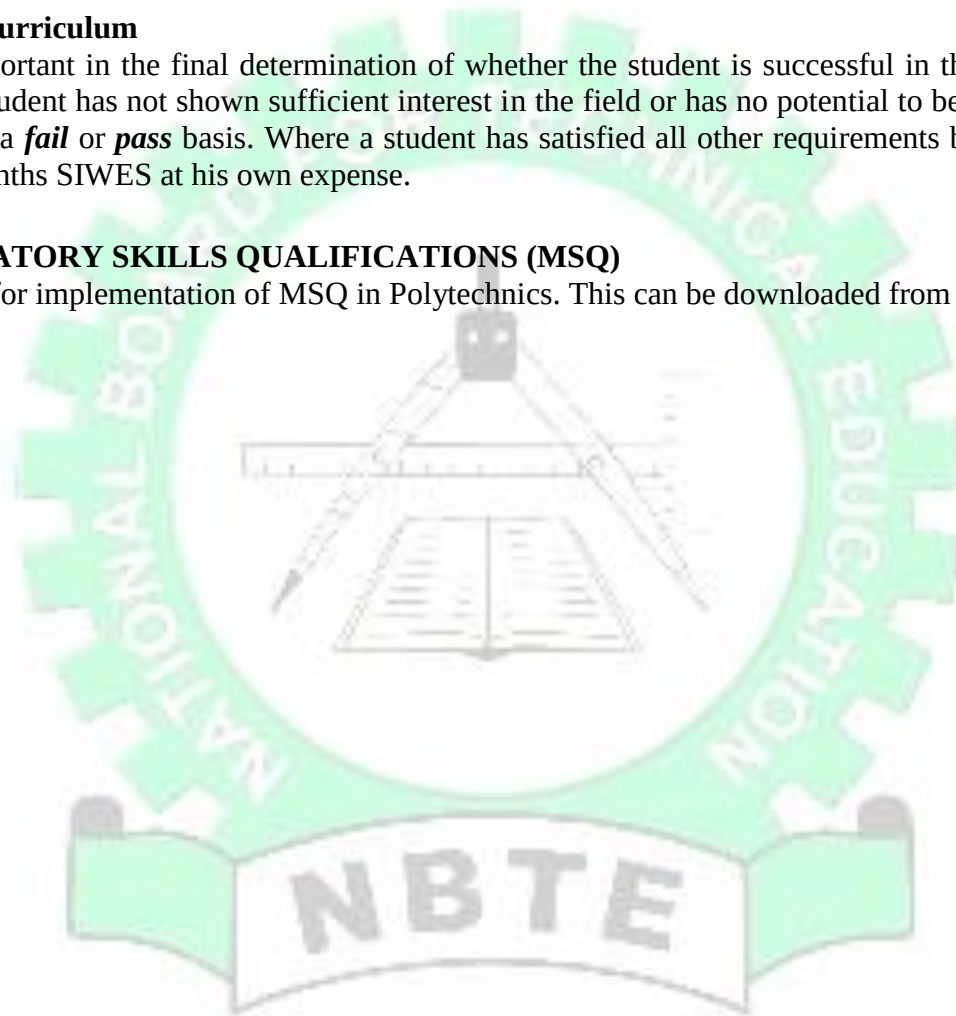
The rate of stipend payable shall be determined from time to time by the Federal Government after due consultation with the Federal Ministry of Education, the Industrial Training Fund and the NBTE.

SIWES as a component of the Curriculum

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

15.0 GUIDELINES ON MANDATORY SKILLS QUALIFICATIONS (MSQ)

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



CURRICULUM TABLE**Year I Semester I**

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 111	Citizenship Education I	2	0	0	2	2
2.	GNS 101	Use of English I	2	0	1	3	3
3.	COM 111	Introduction to Computing	2	0	2	4	4
4.	MSQ 111	Mandatory Skills Qualification	1	0	1	2	2
5.	MEC 113	Basic Workshop Technology and Practice	1	0	3	4	4
6.	AGT 114	Information Communication Technology (ICT) Applications in Agriculture	1	0	2	3	3
7.	FET 114	Introduction to Forestry	1	0	1	2	2
8.	HOT 111	Principles of Horticultural Crop Production	1	0	2	3	3
9.	HOT 112	Nursery Enterprise and Plant Propagation Systems	1	0	2	3	3
10.	HOT 113	Soil and Plant Nutrition for Horticulture	1	0	2	3	3
11.	HOT 114	Vegetable Crop Production I	1	0	2	3	3
12.	HOT 115	Fruit Crop Production I	1	0	2	3	3
TOTAL			15	0	20	35	35

Year I Semester II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 102	Communication in English I	2	0	0	2	2
2.	GNS 211	Citizenship Education II	2	0	0	2	2
3.	ENT 126	Introduction to Entrepreneurship I	2	0	1	3	3
4.	AGT 125	Agro-Climatology	1	0	2	3	3
5.	HOT 121	Vegetable Crop Production II	1	0	2	3	3
6.	HOT 122	Irrigation and Water Management in Horticulture	1	0	2	3	3
7.	HOT 123	Pest and Disease Management in Horticulture	1	0	2	3	3
8.	HOT 124	Protected Horticultural Crop Production	2	0	2	4	4
9.	HOT 125	Field Practical I (Horticultural Production Systems)	0	0	2	2	2
10.	HOT 126	Climate-Smart and Precision Horticultural Production	1	0	3	4	4
11.	HOT 127	Ornamental Horticulture and Landscaping	1	0	2	3	3
TOTAL			14	0	18	32	32

Year II Semester I

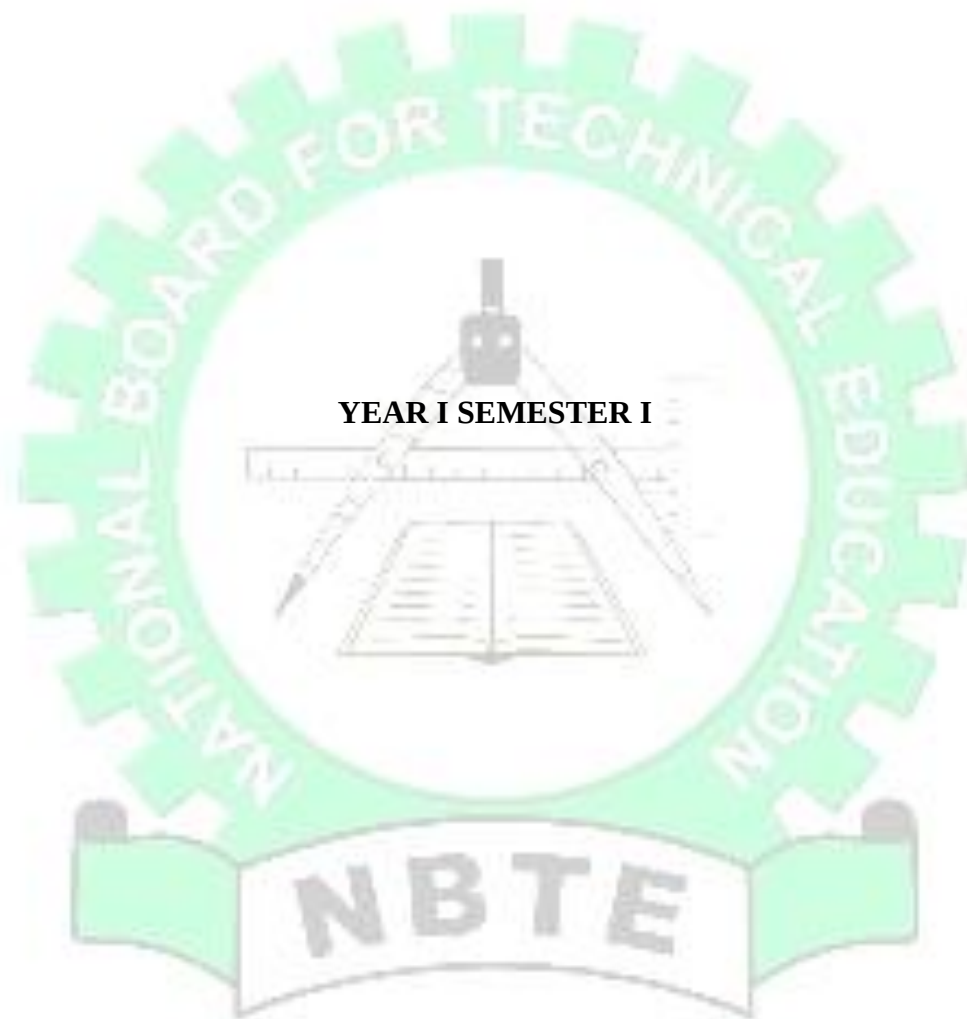
S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 201	Use of English II	2	0	0	2	2
2.	ENT 216	Introduction to Entrepreneurship II	2	0	1	3	3
3.	AGR 201	Research Methods and Experimental Design	1	0	1	2	2
4.	HOT 211	Horticultural Crop Physiology	2	0	2	4	4
5.	HOT 212	Horticultural Business Management	1	0	1	2	2
6.	HOT 213	Field Practical II (Controlled Production Systems)	0	0	2	2	2
7.	HOT 214	Post-Harvest Handling of Horticultural Crops	1	0	2	3	3
8.	HOT 215	Fruit Crop Production II	1	0	2	3	3
9.	HOT 216	Introduction to Beverages and Medicinal Plants	1	0	2	3	3
10.	HOT 217	Students Industrial Work Experience Scheme (SIWES)	0	0	4	4	4
TOTAL			11	0	17	28	28

Year II Semester II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 202	Communication in English II	2	0	0	2	2
2.	AGT 224	Principles of Genetics, Breeding and Biotechnology in Agriculture	1	0	1	2	2
3.	AGT 226	Agricultural Extension, Digital Advisory Systems and Rural Development	1	0	1	2	2
4.	HOT 221	Post-Harvest Technology and Value Addition	1	0	2	3	3
5.	HOT 222	Export Standards and Food Safety Compliance	1	0	2	3	3
6.	HOT 223	Landscaping Design and Urban Horticulture	1	0	2	3	3
7.	HOT 224	Horticultural Agribusiness & Digital Market Access	1	0	2	3	3
8.	HOT 226	Project	0	0	4	4	4
TOTAL			8	0	14	22	22

KEYS:

L = Lectures (hours/week), **T** = Tutorials (hours/week), **P** = Practical (hours/week), **CU** = Credit Units, **CH** = Contact Hours (Hours/week)



YEAR I SEMESTER I

PRINCIPLES OF HORTICULTURAL CROP PRODUCTION

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: PRINCIPLES OF HORTICULTURAL CROP PRODUCTION	COURSE CODE: HOT 111	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide students with the basic knowledge and skills in horticultural crop production.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the scope of horticulture; 2.0 Understand the classification of horticultural crops; 3.0 Understand the principles and methods of horticultural crop propagation; 4.0 Understand nursery and seedbed preparation practices for horticultural crops; 5.0 Understand cultural practices in horticultural crop production; 6.0 Understand the principles and practices of harvesting horticultural produce; 7.0 Understand post-harvest handling of horticultural produce.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: PRINCIPLES OF HORTICULTURAL CROP PRODUCTION			COURSE CODE: HOT 111		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PREREQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with the basic knowledge and skills in horticultural crop production.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Understand the scope of horticulture						
1 - 2	1.1 Define horticulture 1.2 Distinguish horticulture from agronomy and forestry 1.3 List the branches of horticulture. 1.4 Describe the economic importance of horticulture in Nigeria: 1.5 List major horticultural producing areas in	• Explain horticulture • Discuss the differences of horticulture from agronomy and forestry • Explain the branches of horticulture: - Pomology, - Olericulture, - Floriculture, - Landscaping, - Post-harvest	Horticulture comparison chart, Projector, marker board, Journal Textbook Computer Internet	• Conduct a visit to the college horticultural farm and other reputable horticultural enterprise(s) to; - Identify 10 horticultural crops observed. - Classify each under the correct branch of horticulture. • Collect samples of horticultural crops from the college farm.	Guide students to: • Conduct a visit to the college horticultural farm and other reputable horticultural enterprise(s) to; - Identify 10 horticultural crops observed. - Classify each under the correct branch of horticulture. • Collect samples of horticultural crops from the college farm. • Label each	College horticultural farm, crop identification guide/charts/mobile app, specimen bags, sketch map template, plant labels, field notebooks, internet.

	Nigeria and the crops associated with each ecology.	technology, - Plantation, - Viticulture, - Arboriculture, etc. • Discuss the economic importance of horticulture in Nigeria: - Food security, - Employment - Export earnings - Nutrition, etc. • Describe the major horticultural producing areas in Nigeria and the crops associated with each ecology.		• Label each horticultural crop with local name, botanical name and branch of horticulture. • Sketch the college farm layout. • Mark the location of at least four crop types on the sketched farm layout.	horticultural crop with local name, botanical name and branch of horticulture. • Sketch the college farm layout. • Mark the location of at least four crop types on the sketched farm layout.	
General Objective 2.0: Understand the classification of horticultural crops						
3 - 4	2.1 Explain the classification of horticultural crops by life cycle. 2.2 Explain the classification of	• Discuss the classification of horticultural crops by life cycle: annuals, biennials and perennials	Classification charts, botanical name reference list, projector,	• Collect ten horticultural crop samples from the college farm • Classify by; - Taxonomy,	Guide students to: • Collect ten horticultural crop samples from the college farm • Classify by;	Classification charts, crop samples, botanical name reference list, projector, marker

	horticultural crops by use. 2.3 Explain the classification of vegetables by the edible part with examples. 2.4 Explain the classification of fruit crops as tropical, sub-tropical or temperate; 2.5 Differentiate between climacteric and non-climacteric fruits. 2.6 Explain the classification of horticultural crops based on their taxonomy.	• Discuss the Classification of horticultural crops by use: vegetables, fruits, ornamentals, herbs and spices, etc. • Discuss the classification of vegetables by the edible part with examples: root, bulb, leaf, stem, flower and fruit, etc. • Discuss fruit crops as tropical, sub-tropical or temperate. • Differentiate climacteric from non-climacteric fruits. • Describe horticultural crops based on their taxonomy.	marker board, etc.	- Life cycle, - Use - Edible parts. • Prepare a horticultural crop album • Sort a mixed display of twenty samples of horticultural crops into the correct classification groups. • Record the sorted list in a classification table • Identify common Nigerian horticultural crops by local name, botanical name and classification	- Taxonomy, - Life cycle, - Use - Edible parts. • Prepare a horticultural crop album • Sort a mixed display of twenty samples of horticultural crops into the correct classification groups. • Record the sorted list in a classification table • Identify common Nigerian horticultural crops by local name, botanical name and classification	board, internet, mobile application.
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General Objective 3.0: Understand the principles and methods of horticultural crop propagation						
5 - 6	3.1 Define plant propagation. 3.2 Distinguish between sexual and asexual propagation 3.3 State the advantages and disadvantages of sexual and asexual propagation. 3.4 Describe methods of Asexual propagation i.e. natural and artificial 3.5 Describe seed selection criteria: - Viability, - Purity, - Germination percentage - Freedom from pests and diseases. 3.6 Define seed dormancy. 3.7 State the types of seed dormancy	• Discuss plant propagation. • Differentiate between sexual and asexual propagation • Explain the advantages and disadvantages of sexual and asexual propagation. • Discuss methods of Asexual propagation i.e. natural and artificial • Explain seed selection criteria: - viability, - purity, - germination percentage - Free from pests and diseases. • Explain seed dormancy. • Outline the types	Charts, Projector, Marker Board, Internet, Computer.	• Carry out germination test. • Calculate germination percentage. • Identify natural vegetative propagating materials e.g sucker, bulbs, rhizomes, Stolons (runners), etc. • Carry out budding, grafting, layering. • Conduct float test, moist paper test or roll paper test, etc. • Carry out seed treatment using various methods.	Guide students to: • Carry out germination test. • Calculate germination percentage. • Identify natural vegetative propagating materials e.g sucker, bulbs, rhizomes, Stolons (runners), etc. • Carry out budding, grafting, layering. • Conduct float test, moist paper test or roll paper test, etc • Carry out seed treatment using various methods.	Seeds of horticultural crops, germination trays, moist paper, rooting medium, stem cutting material, budding knives, budding tape, grafting knives, rootstock and scion materials, field notebooks, roll paper, cutting stem, petri dish, scion, waxy tape, poly bags, sand paper, hammer, H_2SO_4, HCl, NaOH, KNO_3.

	3.8 State the advantages and disadvantages of seed dormancy. 3.9 Describe seed pre-treatment methods: - Soaking, - Scarification - Hot water treatment 3.10. State one crop requiring each method	of seed dormancy • Discuss the advantages and disadvantages of seed dormancy. • Explain seed pre-treatment methods: - Soaking, - scarification - hot water treatment • State one crop requiring each method				
General Objective 4.0: Understand nursery and seedbed preparation practices for horticultural crops						
7 - 8	4.1 Define a nursery. 4.2 State the types of nurseries. 4.3 State the importance of a nursery 4.4 Enumerate the criteria for selecting a nursery site. 4.5 Describe seedbed	• Explain nursery. • Explain the types of nurseries e.g: - Open-air, - Shade-house - Greenhouse nurseries • Discuss the importance of a nursery	Charts Projector, Marker Board, Journal Internet, Computer	• Set up a nursery on the college farm. • Construct different bed types - Raised, - Flat, - Sunken. • Raise seedlings using poly bags, seed trays,	Guide students to: • Set up a nursery on the college farm. • Construct different seed bed types (raised, flat, sunken). • Raise seedlings using poly bags, seed trays, containers, etc.	Hoes, spades, sterilants, nursery bags, soil, compost, coarse sand, vegetable seeds, watering cans, field notebooks, nursery area.

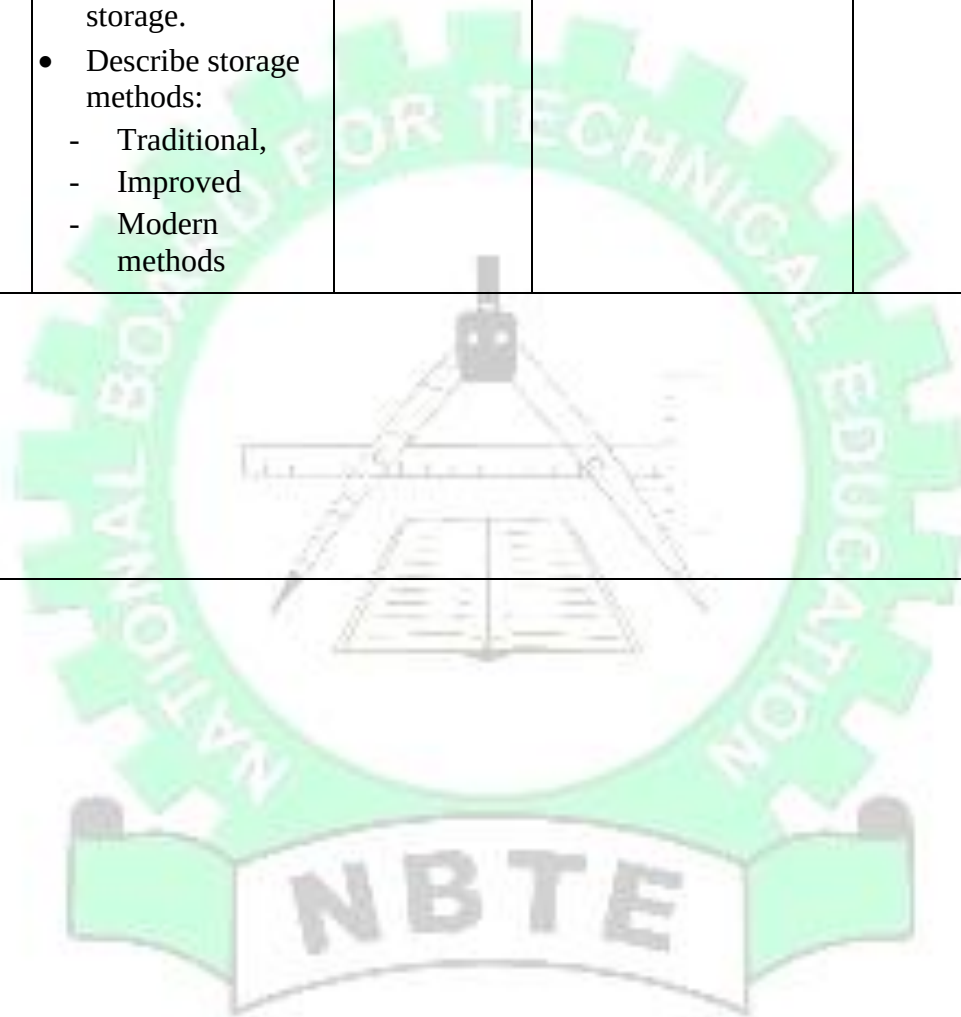
	types. 4.6 Describe the preparation of a nursery growing medium. 4.7 Explain nursery management practices.	• Explain the criteria for selecting a nursery site: - Water supply, - Drainage - Shade, - Security, - Access, etc. • Explain seedbed types: - Flat beds, - Raised beds, - Sunken beds - Container seedbeds • Explain the preparation of a nursery growing medium. • Describe nursery management practices: - Watering - Weeding - Thinning, - Hardening off	containers, etc. • Carry out nursery management practices. • Carryout hardening off before seedling transplanting. • Transplant seedlings • Record survival rate	• Carry out nursery management practices. • Carryout hardening off before seedling transplanting. • Transplant seedlings • Record survival rate	
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		- Transplanting.				
General Objective 5.0: Understand cultural practices in horticultural crop production						
9 - 10	5.1 Explain land preparation steps for horticultural crops. 5.2 Explain planting operations. 5.3 Explain post planting operations for horticultural crops.	- Describe land preparation steps for horticultural crops: - Clearing - Tillage - Bed formation. - Describe planting operations: - Sowing, - Broadcasting, - Spacing, - planting depth, etc. - Explain post planting operations: - Staking, - Mulching, - Supplying (Replanting), - Irrigation, - Weeding, - Fertilizer	Charts Projector, Marker Board, Journal Internet, Computer	- Prepare a plot on the college farm - Clear, till and form beds, ridges, heap. - Carry out planting operations -Sowing (drilling, dibbling, broadcasting) -Transplanting - Carry out post planting operations: - Supplying (Replanting) - Thinning - Weeding - Mulching - Staking - Pruning and trimming - Fertilizer application - Pest and disease control.	Guide students to: - Prepare a plot on the college farm - Clear, till and form beds, ridges, heap. - Carry out planting operations -Sowing (drilling, dibbling, broadcasting) -Transplanting - Carry out post planting operations: - Supplying (Replanting) - Thinning - Weeding - Mulching - Staking - Pruning and trimming - Fertilizer application - Pest and disease control.	Hoes, spades, rakes, watering cans, bamboo stakes, sisal string, mulch material, weighing scale, pruning shears, pest and disease scouting forms, college farm plots, tools and equipment, staking materials, mulch materials, pesticides, PPEs, irrigation equipment, fertiliser samples, weed and disease album, pruning tools, sprayers, Unmanned Aerial Vehicles (UAVs/Drones)" and "GPS.

		application, - Pruning - Trimming, - Pest and disease control, for horticultural crops.				
General Objective 6.0: Understand the principles and practices of harvesting horticultural produce						
11 - 12	6.1 Explain harvesting of horticultural produce. 6.2 List the methods of harvesting horticultural produce. 6.3 List harvesting tools and equipment 6.4 Describe maturity indices for common horticultural crops.	• Discuss harvesting of horticultural produce. • Explain the methods of harvesting horticultural produce. • Describe harvesting tools and equipment • Explain maturity indices for common horticultural crops: - Colour, - Firmness, - Size	Charts Projector, Marker Board, Journal Internet, Computer	• Identify tools and equipment for harvesting of various horticultural crops. • Identify maturity indices of horticultural crops. • Carry out harvesting of horticultural crops. • Carry out maintenance of harvesting tools and equipment.	Guide Students To: • Identify tools and equipment for harvesting of various horticultural crops. • Identify maturity indices of horticultural crops. • Carry out harvesting of horticultural crops. • Carry out maintenance of harvesting tools and equipment.	Maturity indices charts, Knife, cutlass, sickle, shears, bulb harvester, head pan, wheelbarrow, potato harvester.

		- Days to maturity, etc.				
General Objective 7.0: Understand post-harvest handling of horticultural produce						
13 - 15	7.1 Define the term post-harvest. 7.2 State the importance of postharvest in reducing losses of horticultural produce. 7.3 Describe post-harvest operations. 7.4 Describe storage of horticultural produce 7.5 Describe the importance of storage. 7.6 Describe storage methods.	• Explain the term post-harvest. • Explain the importance of postharvest in reducing losses of horticultural produce. • Explain post-harvest operations: - Cleaning, - Sorting, - Grading, - Threshing, - Winnowing, - Packaging - Labelling. • Discuss storage of horticultural produce	Charts Projector, Marker Board, Journal Internet, Computer	• Sort the harvested produce into quality grades. • Package each grade using appropriate materials. • Carry out storage of horticultural produce using different methods.	Guide students to: • Sort and grade the harvested produce into quality grades. • Package each grade using appropriate materials. • Carry out storage of horticultural produce using different methods.	Mature harvested horticultural produce on college farm, grading containers, packaging materials, crates, basket, weighing scale, labels, clay pots, wet sand, thermometer.

		• Discuss the importance of storage. • Describe storage methods: - Traditional, - Improved - Modern methods				
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



NURSERY ENTERPRISE AND PLANT PROPAGATION SYSTEMS

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: NURSERY ENTERPRISE AND PLANT PROPAGATION SYSTEMS	COURSE CODE: HOT 112	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in nursery enterprise management and plant propagation.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand types of nursery enterprises; 2.0 Understand seedling production techniques; 3.0 Know natural vegetative propagation techniques; 4.0 Know artificial propagation techniques; 5.0 Understand nursery growth media preparation; 6.0 Understand nursery enterprise management and commercialization.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: NURSERY ENTERPRISE AND PLANT PROPAGATION SYSTEMS			COURSE CODE: HOT 112		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PREREQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in nursery enterprise management and plant propagation.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Understand types of nursery enterprises						
1 - 2	1.1 Define a nursery enterprise. 1.2 State the importance of a nursery enterprise in horticultural production. 1.3 Describe types of nurseries. 1.4 List the requirements for establishing	• Explain a nursery enterprise. • Discuss the importance of a nursery enterprise in horticultural production. • Explain types of nurseries: - Vegetable - seedling, - fruit tree, - ornamental, - forest nurseries, etc. • Explain the requirements for establishing a commercial nursery. • Discuss market outlets for nursery products in Nigeria.	Charts Projector, Marker Board, Journal Internet, Computer	• Conduct a visit to a nursery. • Identify nursery type, products with prices and management practice observed. • Sketch and label the college nursery layout identifying all structures and growing areas. with labels • Prepare a simple enterprise plan for	Guide students to: • Conduct a visit to a nursery. • Identify nursery type, products with prices and management practice observed. • Sketch and label the college nursery layout identifying all	College or commercial nursery, sketch template, enterprise plan template, bill of quantities template, field notebooks.

	a commercial nursery. 1.5 Describe market outlets for nursery products in Nigeria. 1.6 State career opportunities for ND graduates in the nursery sub-sector	• Explain career opportunities for ND graduates in the nursery sub-sector		a seedling nursery. • Prepare a bill of quantities for a 100-seedling nursery • Interview the nursery manager • Record three challenges and their solutions.	structures and growing areas. • Prepare a simple enterprise plan for a seedling nursery. • Prepare a bill of quantities for a 100-seedling nursery • Interview the nursery manager • Record three challenges and their solutions.	
General Objective 2.0: Understand seedling production techniques						
3– 4	2.1 Describe seed quality testing methods. 2.2 Describe seed pre-treatment methods. 2.3 Describe seedbed	• Explain seed quality testing methods: - float test, - germination test, etc. • Explain seed pre-treatment methods: - soaking,	Charts Projector, Marker Board, Journal Internet, Computer	• Carry out float test and germination test on two horticultural crops • Calculate germination	Guide Students to: • Carry out float test and germination test on two horticultural crops	Seeds, nursery bags, growing medium, watering cans, fertilisers, pesticides, hand trowel,

	preparation and direct sowing for horticultural crops. 2.4 Explain container seedling production: filling bags, sowing depth and labelling. 2.5 Describe seedling management. 2.6 Describe hardening off procedures before transplanting or sale.	- scarification, - hot water treatment, etc. • Explain seedbed preparation and direct sowing for horticultural crops. • Describe container seedling production: filling bags, sowing depth and labelling. • Discuss seedling management: - watering, - fertilizing, - shade management, etc. • Explain hardening off procedures before transplanting or sale.	percentage • Fill nursery bags and sow one horticultural crop at correct depth. • Carry out seedling management and monitor horticultural crops performance. • Carry out hardening of horticultural crops. • Prepare a seedling production • Record with all key dates from sowing to transplanting	• Calculate germination percentage • Fill nursery bags and sow one horticultural crop at correct depth. • Carry out seedling management and monitor horticultural crops performance. • Carry out hardening off of horticultural crops. • Prepare a seedling production • Record with all key dates from sowing to transplanting	hand fork, observation sheet, production record form,
General Objective 3.0: Know natural vegetative propagation techniques					

5 – 7	3.1 Explain the natural means of vegetative propagation: 3.2 Describe division propagation. 3.3 Describe common rooting media. 3.4 Explain factors affecting rooting success.	• Discuss the natural means of vegetative propagation: - Suckers. - Rhizomes - Tubers - Bulbs - Corms - Stolons • Explain division propagation: - Suitable crops, - Procedure - Management • Explain common rooting media: - river sand, - coco peat - soil-compost mix. • Discuss factors affecting rooting success: - Humidity, - Temperature - Rooting hormone	Charts Projector, Marker Board, Journal Internet, Computer	• Carry out natural vegetative propagation. • Carry out division of horticultural crops involving: - Clump-forming system (e.g. lemongrass), suckers (pineapple, banana), - Rhizomes (ginger), - Corms (cocoyam) - Offset (pups) e.g. Aloe vera, etc., • Compare rooting of hormone-treated and untreated cuttings. Calculate percentage rooting for each	Guide students to: • Carry out natural vegetative propagation. • Carry out division of horticultural crops involving: - Clump-forming system (e.g. lemongrass), suckers (pineapple, banana), - Rhizomes (ginger), - Corms (cocoyam) - Offset (pups) e.g. Aloe vera, etc., • Compare rooting of hormone-treated and untreated	Seeds of peppers, okra, cucumber, Suckers of pineapple or plantain; bulbs of onion or tulips, tubers of yam or cassava, rhizomes of ginger and turmeric; vines of grapes, cucumbers, potatoes; Stolon of strawberries etc. Cutting material, rooting media, nursery bags, sphagnum moss, polythene strips, rooting hormone, propagation record form, field notebooks.
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					cuttings. Calculate percentage rooting for each	
General Objective 4.0: Know artificial propagation techniques						
8 - 10	4.1 Describe stem cutting types with examples. 4.2 Explain layering types, its steps and suitable crops. 4.3 Describe budding. 4.4 Explain types of budding 4.5 Describe grafting. 4.6 Explain types of grafting 4.7 Explain factors affecting budding and grafting success. 4.8 Describe the assessment of bud or graft.	• Explain stem cutting types with examples. • Discuss layering types, its steps and suitable crops. • Discuss budding: - Rootstock preparation, - bud insertion, - Bud wrapping - Bud management. • Discuss types of budding • Discuss grafting: - Rootstock cutting, - Scion wedge preparation, - Scion insertion - Scion wrapping. • Discuss types of grafting • Discuss factors affecting budding and grafting success: - Compatibility, - Hygiene - Season. • Explain the assessment of bud	Charts Projector, Marker Board, Journal Internet, Computer	• Carry out stem cutting propagation for various horticultural plants. • Carry out layering on a college farm shrub. • Carry out budding • Carry out grafting	Guide students to: • Carry out stem cutting propagation for various horticultural plants. • Carry out layering on a college farm shrub. • Carry out budding • Carry out grafting	Budding and grafting knives, budding tape, grafting tape, rootstocks, scion wood, success record form.

		or graft.				
General Objective 5.0: Understand nursery growth media preparation						
11 – 13	5.1 Explain growth media components. 5.2 State the role of each growth media. 5.3 Describe growth media mixes for vegetable seedlings, fruit tree seedlings and ornamentals. 5.4 Explain soil sterilization, 5.5 Explain its objectives, and methods. E.g. solarization, hot water treatment, chemicals. 5.6 Describe container types. 5.7 Describe re-potting indicators, technique and post-repotting management	- Describe growth media components: - Topsoil, - Compost, - River sand - Coco peat - Explain the role of each growth media. - Explain growth media mixes for vegetable seedlings, fruit tree seedlings and ornamentals. - Discuss soil sterilization, - Discuss its objectives, and methods. E.g - Solarization, - Hot water treatment, - Chemicals. - Describe container types: - Nursery bags, - Seedling trays - Pots - Root trainers. - Discuss re-potting indicators, technique and post-repotting management	Charts Projector, Marker Board, Journal Internet, Computer	- Prepare growth medium mixes for vegetable, fruit, tree and ornamental. - Carry out soil sterilization using various methods. - Re-pot seedlings into larger containers, - Arrange filled containers in the nursery at correct spacing. - Calculate growth medium volumes	Guide students to: - Prepare growth medium mixes for vegetable, fruit, tree and ornamental. - Carry out soil sterilization using various methods. - Re-pot seedlings into larger containers, - Arrange filled containers in the nursery at correct spacing. - Calculate	Growing medium components, nursery bags, seedling trays, pots, transparent polythene, thermometer, calculation worksheet, chemicals for sterilization.

				needed for 200 nursery bags Record all steps	growth medium volumes needed for 200 nursery bags Record all steps	
General Objective 6.0: Understand nursery enterprise management and commercialization						
14 - 15	6.1 Describe nursery record keeping. 6.2 Explain nursery pricing. 6.3 Describe marketing channels. 6.4 Describe packaging and labelling of nursery plants for sale. 6.5 Explain the use of WhatsApp Business to promote and sell nursery products.	- Explain nursery record keeping: - Stock, - Sales, - Input - Production calendar records. - Discuss nursery pricing: - Cost of production, - Profit margin - Selling price. - Explain marketing channels: - Farm gate - Markets - Landscaping contracts - Online sales. - Discuss packaging and labelling of nursery plants	Sample record forms, pricing worksheet, marketing guide, packaged plant samples, smartphone with WhatsApp Business, projector, internet, calculators.	- Complete nursery stock record for the college nursery - Calculate cost of production and selling price for one batch of seedlings - Package and label nursery plants for sale - Display attractively - Set up a WhatsApp Business catalogue with nursery products including photographs and	Guide students to: - Complete nursery stock record for the college nursery - Calculate cost of production and selling price for one batch of seedlings - Package and label nursery plants for sale - Display attractively - Set up a WhatsApp Business catalogue with nursery	Stock record template, cost calculation worksheet, packaging materials, plant labels, smartphone with WhatsApp Business, income statement template, calculators.

WhatsApp Business to promote and sell nursery products.		income statement • Compute gross margin and net profit
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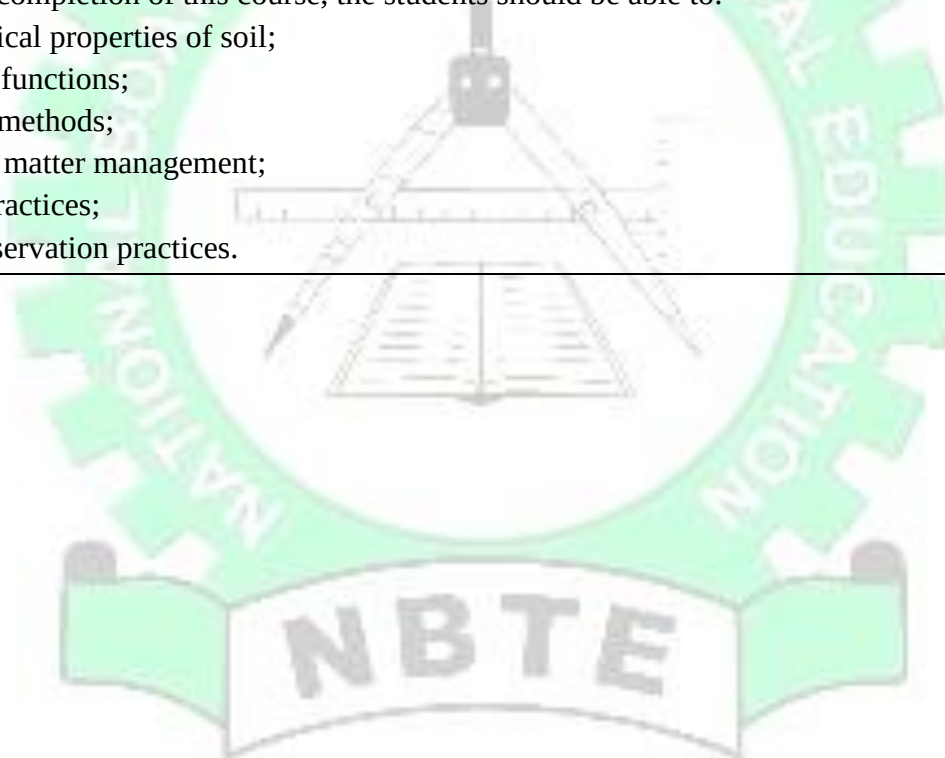
SOIL AND PLANT NUTRITION FOR HORTICULTURE**PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY**

COURSE TITLE: SOIL AND PLANT NUTRITION FOR HORTICULTURE	COURSE CODE: HOT 113	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK

GOAL: This course is designed to provide students with knowledge and skills in soils and plant nutrition for horticultural crop production.

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

- 1.0 Understand physical and chemical properties of soil;
- 2.0 Know plant nutrients and their functions;
- 3.0 Know soil fertility assessment methods;
- 4.0 Know composting and organic matter management;
- 5.0 Know fertilizer management practices;
- 6.0 Understand soil and water conservation practices.



PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: SOIL AND PLANT NUTRITION FOR HORTICULTURE		COURSE CODE: HOT 113		CONTACT HOURS: 3 HOURS/WEEK		
		CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK		
YEAR: I SEMESTER: I		PREREQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills in soils and plant nutrition for horticultural crop production.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Understand physical and chemical properties of soil						
1 – 3	1.1 Describe soil composition. 1.2 Classify soil by texture 1.3 Describe the suitability of each soil. 1.4 Describe soil structure 1.5 Explain the importance of soil structure. 1.6 Explain soil pH and its effect on horticultural crops. 1.7 Describe soil	- Discuss soil composition: - Mineral particles, - Organic matter, - Water - Air. - Explain the Classification of Soil by texture - Explain the suitability of each soil: - Sand, - Clay - Silt, etc. - Discuss soil structure - Explain the importance of soil structure:	Charts Projector, Marker Board, Journal Internet, Computer	- Carry out the texture feel test on three farm soil samples - Record texture class for each. - Observe the colour for each - Test pH of three soil samples - Compare with ideal range for tomato, pepper and leafy vegetables. - Collect a composite soil sample at 0–15 cm depth	Guide students to: - Carry out the texture feel test on three farm soil samples - Record texture class for each. - Observe the colour for each - Test pH of three soil samples - Compare with ideal range for tomato, pepper and leafy	Soil samples, pH meter or soil test kit, sampling auger, sample bags, weighing scale, tensiometer, nutrient availability chart, ruler, graduated cylinder, soil profile sketch template.

	water.	- Aggregation - Porosity - Bulk density - Drainage. • Describe soil pH and its effect on horticultural crops. • Describe soil water: - Field capacity, - Water logging, - Water stress, - Wilting point - Plant-available water.		• Record procedure, date and depth. • Determine field capacity of one sample by saturation and 48-hour drainage • Calculate as percentage of dry weight • Prepare a soil profile sketch for the college farm • Label topsoil and subsoil with depth and colour. • Conduct potted experiment to determine water logging, water stress and wilting point	vegetables. • Collect a composite soil sample at 0–15 cm depth • Record procedure, date and depth. • Determine field capacity of one sample by saturation and 48-hour drainage • Calculate as percentage of dry weight • Prepare a soil profile sketch for the college farm • Label topsoil and subsoil with depth and colour. • Conduct potted experiment to determine water logging, water stress	
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					and wilting point	
General Objective 2.0: Know plant nutrients and their functions						
4 – 5	2.1 Classify plant nutrients as macronutrients and micronutrients. 2.2 State the functions of macro and micro nutrients. 2.3 State deficiency symptoms of macro and micro nutrients. 2.4 Describe organic and inorganic sources of major plant nutrients. 2.5 Explain cost and availability of organic and inorganic nutrient sources.	• Explain macro and micro nutrients with examples of each. • Explain the functions of macro and micro nutrients with crop examples. • Explain deficiency symptoms of macro and micro nutrients. • Discuss organic and inorganic sources • Discuss cost and availability of organic and inorganic nutrient sources.	Charts Projector, Marker Board, Journal Internet, Computer	• Observe and record deficiency symptoms on farm plants. • Identify probable deficient nutrient for each plant. • Prepare a nutrient omission techniques for N, P, K and Fe with symptom description and corrective action. • Examine five fertiliser bags in the college store • Record nutrient content, rate and price. • Calculate NPK content in kg per bag for three fertilisers • Record all steps • Prepare a	Guide students to: • Observe and record deficiency symptoms on farm plants. • Identify probable deficient nutrient for each plant. • Prepare a nutrient omission techniques for N, P, K and Fe with symptom description and corrective action. • Examine five fertiliser bags in the college store • Record nutrient content, rate and price.	Nutrient deficient plants or photographs, reference card template, fertiliser bags from store, macro and micronutrients function diagrams, calculation worksheet, function table template, field notebooks, projector, internet, mobile application.

				nutrient function table for six macronutrients mentioning the main function and one deficiency symptom for each	• Calculate NPK content in kg per bag for three fertilizers • Record all steps • Prepare a nutrient function table for six macronutrients mentioning the main function and one deficiency symptom for each	
General Objective 3.0: Know soil fertility assessment methods						
6 – 7	3.1 Define soil fertility. 3.2 Enumerate the importance of soil fertility for horticultural yield and quality. 3.3 Describe soil fertility assessment methods. 3.4 Explain soil sample collection. 3.5 Explain a soil test	• Discuss soil fertility. • Explain the importance of soil fertility for horticultural yield and quality. • Explain soil fertility assessment methods: - Soil testing, - Tissue analysis - Visual observation. • Describe soil sample collection. • Describe a soil test report to apply fertiliser	Charts Projector, Marker Board, Journal Internet, Computer	• Collect a composite soil sample using the W-path method • Label correctly with location and depth • Carry out a soil test for pH, N, P and K on two college farm plots • Record and	Guide students to: • Collect a composite soil sample using the W-path method • Label correctly with location and depth • Carry out a soil test for pH, N, P and K on two college farm plots	Soil sampling equipment, soil test kit, sample test report, recommendation guide, fertility assessment guide, mobile app., recording form, calculator.

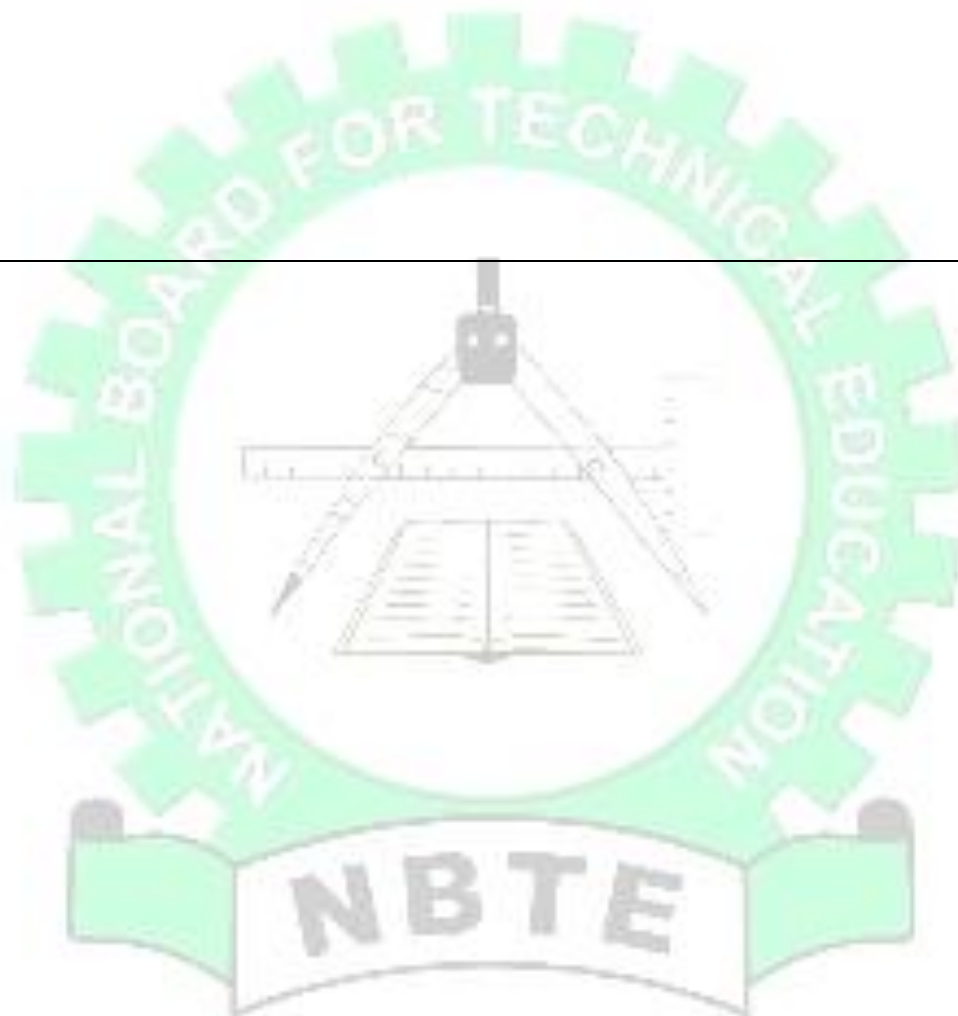
	report to apply fertiliser recommendations 3.6 Describe biological indicators of soil fertility.	recommendations • Describe biological indicators of soil fertility: - Earthworm count, - Decomposition rate, etc.		compare results • Interpret a provided soil test report. • Write a fertiliser recommendation for one horticultural crop. • Count earthworms in three 30 cm x 30 cm x 30 cm pits • Calculate average population per square metre. • Compare soil condition of a well-managed plot with a degraded plot • Record differences in colour and structure	• Record and compare results • Interpret a provided soil test report. • Write a fertiliser recommendation for one horticultural crop. • Count earthworms in three 30 cm x 30 cm x 30 cm pits • Calculate average population per square metre. • Compare soil condition of a well-managed plot with a degraded plot • Record differences in colour and structure	
General Objective 4.0: Know composting and organic matter management						
8 –	4.1 Explain organic	• Discuss organic inputs and	Charts	• Construct a	Guide students to:	Organic

10	inputs and its types. 4.2 Describe the role of organic matter in soil fertility. 4.3 Describe the composting process. 4.4 Describe characteristics of mature compost. 4.5 Explain vermicomposting	its types: - Compost, - Farmyard manure, - Green manure, - Vermicompost, etc. • Explain the role of organic matter in soil fertility: - Nutrients, - Water retention - Biological activity. • Explain the composting process: - Materials, - Layering, - Turning - Maturity assessment. • Discuss characteristics of mature compost: - Temperature - Smell, - Colour, etc. • Describe vermicomposting: - Worm species - Bin setup - Management - Harvest	Projector, Marker Board, Journal Internet, Computer	compost pile using green and brown materials • Record dimensions and starting date. • Show different types of organic inputs • Monitor the pile periodically • Record temperature, • Identify colour change and monitor smell. • Test a sample of mature compost for colour, smell, texture, etc. stating whether it is ready. • Set up a vermicompost bin with red worms and organic waste; record setup date and observed periodically.	• Construct a compost pile using green and brown materials • Record dimensions and starting date. • Show different types of organic inputs • Monitor the pile periodically • Record temperature, • Identify colour change and monitor smell. • Test a sample of mature compost for colour, smell, texture, etc. stating whether it is ready. • Set up a vermicompost bin with red worms and organic waste; record setup date and observed	materials, compost tools, thermometer, watering can, mature compost, germination seeds, vermicompost bin, red worms, weighing scale.
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				• Calculate compost quantity for a 5 m x 2 m bed at 10 t/ha • Apply to a vegetable bed	• periodically. • Calculate compost quantity for a 5 m x 2 m bed at 10 t/ha • Apply to a vegetable bed	
General Objective 5.0: Know fertiliser management practices						
11 – 13	5.1 Classify fertilizers with examples 5.2 Explain fertilizer application methods. 5.3 Explain fertilizer application rates. 5.4 Explain the harmful effects of fertilizer over-application on crops and the environment	• Classify fertilizers: - Straight, - Compound - Slow-release - Foliar • with examples • Describe fertilizer application methods. • Describe fertilizer application rates. • Describe the harmful effects of fertilizer over-application on crops and the environment	Charts Projector, Marker Board, Journal Internet, Computer	• Calculate fertiliser quantity for a horticultural crop per hectare. • Apply fertiliser using different methods. • Apply a foliar fertilizer • Calculate dilution rates, • Prepare solution and spray. • Compare plant height and leaf colour in a fertilized plot and an unfertilized control at 3 weeks.	Guide students to: • Calculate fertiliser quantity for a horticultural crop per hectare. • Apply fertiliser using different methods. • Apply a foliar fertilizer • Calculate dilution rates, • Prepare solution and spray. • Compare plant height and leaf colour in a fertilised plot and an unfertilised control at 3 weeks.	NPK and foliar fertiliser, weighing scale, measuring tape, knapsack sprayer, calculation worksheet.

General Objective 6.0: Understand soil and water conservation practices						
14 – 15	6.1 Explain causes and effects of soil erosion on horticultural farms. 6.2 Explain soil conservation practices. 6.3 Explain water conservation practices. 6.4 Explain tillage practices with its benefits. 6.5 Explain signs of soil degradation 6.6 Explain methods for reclaiming degraded soil	- Describe causes and effects of soil erosion on horticultural farms. - Describe soil conservation practices: - Mulching, - Cover cropping, - Contour ridging, - Windbreaks, etc. - Describe water conservation practices: - Mulching - Drip irrigation, - Rainwater harvesting, etc. - Discuss tillage practices with its benefits. - Describe signs of soil degradation - Describe methods for reclaiming degraded soil	Charts Projector, Marker Board, Journal Internet, Computer	- Identify various signs of erosion or degradation on a farm - Recommend conservation practice for each. - Carry out soil conservation practice using various techniques. - Construct water conservation practices: - Mulching - Drip irrigation, etc. - Carry out tillage practices. - Design a soil and water conservation plan for the college farm. - Sketch erosion-prone areas with proposed	Guide students to: - Identify various signs of erosion or degradation on a farm - Recommend conservation practice for each. - Carry out soil conservation practice using various techniques. - Construct water conservation practices: - Mulching - Drip irrigation, etc. - Carry out tillage practices. - Design a soil and water conservation plan for the college farm. - Sketch erosion-prone areas with proposed practices.	Mulch materials, hoes, drip hose, water harvesting structures, moisture meter or feel method, conservation plan template, sketch paper, internet, degraded land, erosion sites, tillage implements

				practices.		
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



VEGETABLE CROP PRODUCTION I

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: VEGETABLE CROP PRODUCTION I	COURSE CODE: HOT 114	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills to produce common leafy, fruit and root vegetables in Nigeria.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the scope and importance of vegetable production in Nigeria; 2.0 Know the production practices for leafy vegetables; 3.0 Know the production practices for fruit vegetables; 4.0 Know the production practices for root and bulb vegetables; 5.0 Understand pest and disease management in vegetable production; 6.0 Understand harvesting and post-harvest handling of vegetables.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: VEGETABLE CROP PRODUCTION I		COURSE CODE: HOT 114		CONTACT HOURS: 3 HOURS/WEEK		
		CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK		
YEAR: I SEMESTER: I		PREREQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills to produce common leafy, fruit and root vegetables in Nigeria.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Understand the scope and importance of vegetable production in Nigeria						
1 – 2	1.1 Explain vegetable crop production 1.2 State the importance of vegetable crops production in Nigeria. 1.3 List the major vegetable producing areas in Nigeria and their crops. 1.4 Describe site selection factors for vegetable production. 1.5 Describe constraints to vegetable production and possible solutions	• Discuss vegetable crop production • Explain the importance of vegetable crops production in Nigeria. • Explain the major vegetable producing areas in Nigeria and their crops. • Explain site selection factors for vegetable production. • Enumerate constraints to vegetable production and possible solutions	LCD projector, whiteboard, markers Computer Nigerian vegetable map, site selection checklist, projector.	• Conduct a visit to the college garden or any reputable garden. • Identify vegetable crops cultivated. • Identify and differentiate various sites for vegetable crop production. • Evaluate the college farm site using a selection checklist • Identify two strong and two weak features	Guide students to: • Conduct a visit to the college garden or any reputable garden. • Identify vegetable crops cultivated. • Identify and differentiate various sites for vegetable crop production. • Evaluate the college farm site using a selection checklist • Identify two strong	Crop identification guide, Site selection checklist.

					and two weak features	
General Objective 2.0: Know the production practices for leafy vegetables						
3 – 4	2.1 List common leafy vegetables. 2.2 State local and botanical names for each. 2.3 List common cultivars of each of the Vegetables. 2.4 Describe the agronomic requirements of leafy vegetables. 2.5 Describe production practices of leafy vegetables. 2.6 Describe harvesting practices of leafy vegetables.	• Enumerate common leafy vegetables. • State local and botanical names for each. • Describe common cultivars of each of the Vegetables. • Explain the agronomic requirements of leafy vegetables: - Soil - pH, - Temperature - Rainfall, etc. • Explain production practices of leafy vegetables: - Land preparation, - Planting method, - Nursery, - Spacing - Weeding,	LCD projector, whiteboard, markers Computer Nigerian vegetable map, site selection checklist, projector.	• Identify common leafy vegetables • Sow or transplant leafy vegetable at correct spacing and plant population. • Carry out cultural management practices on leafy vegetable crops • Harvest leafy vegetable crops at correct maturity	Guide students to: • Identify common leafy vegetables • Sow or transplant leafy vegetable at correct spacing and plant population. • Carry out cultural management practices on leafy vegetable crops • Harvest leafy vegetable crops at correct maturity	Seeds or seedlings, hoes, compost, fertiliser, watering cans, observation sheet, weighing scale.

		- Fertiliser application, - Irrigation management. • Explain the harvesting practices of leafy vegetables.				
General Objective 3.0: Know the production practices for fruit vegetables						
5 – 7	3.1 List common fruit vegetables with their local and botanical names. 3.2 State common cultivars of each fruit vegetable. 3.3 Describe agronomic requirements of fruit vegetables. 3.4 Describe the production practices for fruit vegetable crops: tomato, pepper, okra, etc. 3.5 Describe maturity indices for fruit vegetable crops. 3.6 Describe harvesting practices of fruit vegetables.	• Enumerate common fruit vegetables with their local and botanical names. • State common cultivars of each fruit vegetable. • Explain the agronomic requirements of fruit vegetables: - Soil - pH, - Temperature, - Rainfall, etc. • Describe production practices for fruit vegetable crops: - Nursery seedling production, - Transplanting,	LCD projector, whiteboard, markers Computer Nigerian vegetable map, site selection checklist, projector.	• Identify fruit vegetables. • Raise tomato or pepper seedlings in the nursery. • Transplant seedlings to the farm at correct spacing • Carry out production practices: - Staking, - Weeding, - Mulching, - Fertilizer application, etc. • Harvest at correct maturity	Guide students to: • Identify fruit vegetables. • Raise tomato or pepper seedlings in the nursery. • Transplant seedlings to the farm at correct spacing • Carry out production practices: - Staking, - Weeding, - Mulching, - Fertilizer application, etc. • Harvest at correct maturity	Seeds or seedlings, nursery trays, bamboo stakes, sisal string, fertilizer, pruning shears, mulch materials, pesticides, weighing scale.

		- Spacing, - Weeding, - Staking, - Mulching - Pruning, - Fertilizer application • Explain maturity indices for fruit vegetables. • Discuss harvesting practices of fruit vegetables.				
General Objective 4.0: Know the production practices for root and bulb vegetables						
8 – 10	4.1 List common root and bulb vegetables with their local and botanical names. 4.2 List the common cultivars of root and bulb vegetable crops. 4.3 Describe agronomic requirements for root and bulb vegetables. 4.4 Describe production practices for root and bulb vegetables. 4.5 Describe maturity indices, harvesting and	• Discuss common root and bulb vegetables with their local and botanical names. • Explain the common cultivars of root and bulb vegetable crops. • Explain agronomic requirements for root and bulb vegetables: - Temperature, - Rainfall, - Humidity, - Soil,	LCD projector, whiteboard, markers Computer Nigerian vegetable map, site selection checklist, projector.	• Identify root and bulb vegetables. • Raise root and bulb vegetable crop • Carry out necessary production practices. • Harvest root and bulb vegetable crops at correct maturity • Record yield.	Guide students to: • Identify root and bulb vegetables. • Raise root and bulb vegetable crop • Carry out necessary production practices. • Harvest root and bulb vegetable crops at correct maturity • Record yield.	Carrot seeds or onion sets, hoes, spades, compost, fertiliser, pesticides, watering cans, weighing scale.

	curing for each crop	- pH. • Discuss production practices for root and bulb vegetables: - Land preparation, - Sowing, - Thinning, - Earthing up - Irrigation, - Weeding, - Fertilizer application, - Pest and disease control, etc. • Explain maturity indices, harvesting and curing each crop				
General Objective 5.0: Understand pest and disease management in vegetable crop production						
11 – 13	5.1 List common pests of vegetable crops. 5.2 Describe the nature of damages caused by the pests. 5.3 List common diseases of vegetable crops. 5.4 Describe the symptoms of every disease mentioned above.	• Discuss common pests of vegetable crops: - Aphids, - Whitefly, - Caterpillars - Thrips, etc. • Explain the nature of damages caused by the pests. • Discuss common	Pest and disease album/charts, damage/symptoms, whiteboard, markers Computer Nigerian vegetable map, site selection checklist, projector.	• Observe pest infested or diseased plants, part affected. • Record nature of damage observed and possible causative agent. • Carry out pest and disease control: - Cultural,	Guide students to: • Observe pest infested or diseased plants, part affected. • Record nature of damage observed and possible causative agent. • Carry out pest and disease control:	Sweep net, specimen bags, hand lens neem leaves, pesticides, extraction equipment, knapsack sprayer, PPE set.

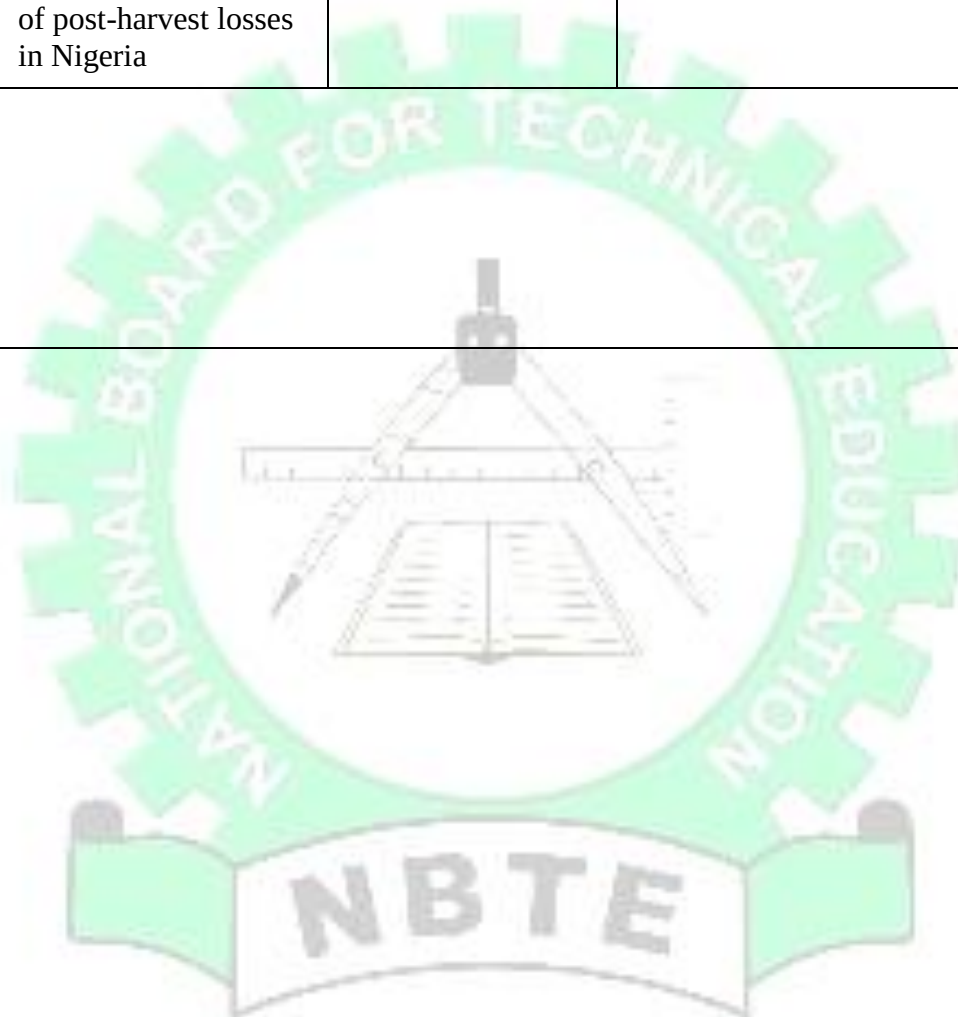
	5.5 Explain pest and disease management. 5.6 Describe safety precautions in pesticide use. 5.7 Explain preparation and application of botanical pesticide e.g. neem or chili.	diseases of vegetable crops; - Damping off, - Early blight - Bacterial wilt, etc. • Explain the symptoms of every disease mentioned above. • Discuss pest and disease management: - Cultural, - Physical/mechanical, - Biological, - Chemical, - Botanical, - Integrated control. • Explain safety precautions in pesticide use: - PPE, - Dosage calculation - Pre-harvest interval. • Discuss preparation and application of		- Chemical, etc. • Prepare botanical pesticide e.g. neem extract. • Apply botanical pesticide on diseased or pest infested plant • Observe changes. • Calculate volume of synthetic pesticide for 10 litres at the label rate • Demonstrate correct donning and doffing of PPE	- Cultural, - Chemical, etc. • Prepare botanical pesticide e.g. neem extract. • Apply botanical pesticide on diseased or pest infested plant • Observe changes. • Calculate volume of synthetic pesticide for 10 litres at the label rate; • Demonstrate correct donning and doffing of PPE	
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		botanical pesticide e.g. neem or chili				
General Objective 6.0: Understand harvesting and post-harvest handling of vegetables						
14 – 15	6.1 Describe maturity indices for common vegetables. 6.2 Explain harvesting methods and tools for leafy, fruit, root and bulb vegetables. 6.3 Describe post-harvest operations. 6.4 Describe simple storage methods. 6.5 Describe common causes and prevention of post-harvest losses in Nigeria	• Explain maturity indices for common vegetables: - Colour, - Firmness, - Size - Days from planting. • Describe harvesting methods and tools for leafy, fruit, root and bulb vegetables. • Describe post-harvest operations: - Sorting, - Grading, - Cleaning, - Packaging - Labelling. • Discuss simple storage methods: - Ambient, - Evaporative - Cooler - Shade storage.	LCD projector, whiteboard, markers Computer Nigerian vegetable map, site selection checklist, projector.	• Harvest vegetable crops from the college farm • Record maturity signs, quantity and methods for each. • Sort and grade harvested produce into quality classes • Package and label graded produce • Store harvested produce using appropriate storage structures • Compare produce quality in different storage structures for; firmness, colour and smell	Guide students to: • Harvest vegetable crops from the college farm • Record maturity signs, quantity and methods for each. • Sort and grade harvested produce into quality classes • Package and label graded produce • Store harvested produce using appropriate storage structures • Compare produce quality in different storage structures for; firmness, colour and smell	Mature vegetables, harvesting tools, grading containers, packaging materials, weighing scale, clay pots, wet sand, thermometer.

		Discuss common causes and prevention of post-harvest losses in Nigeria				
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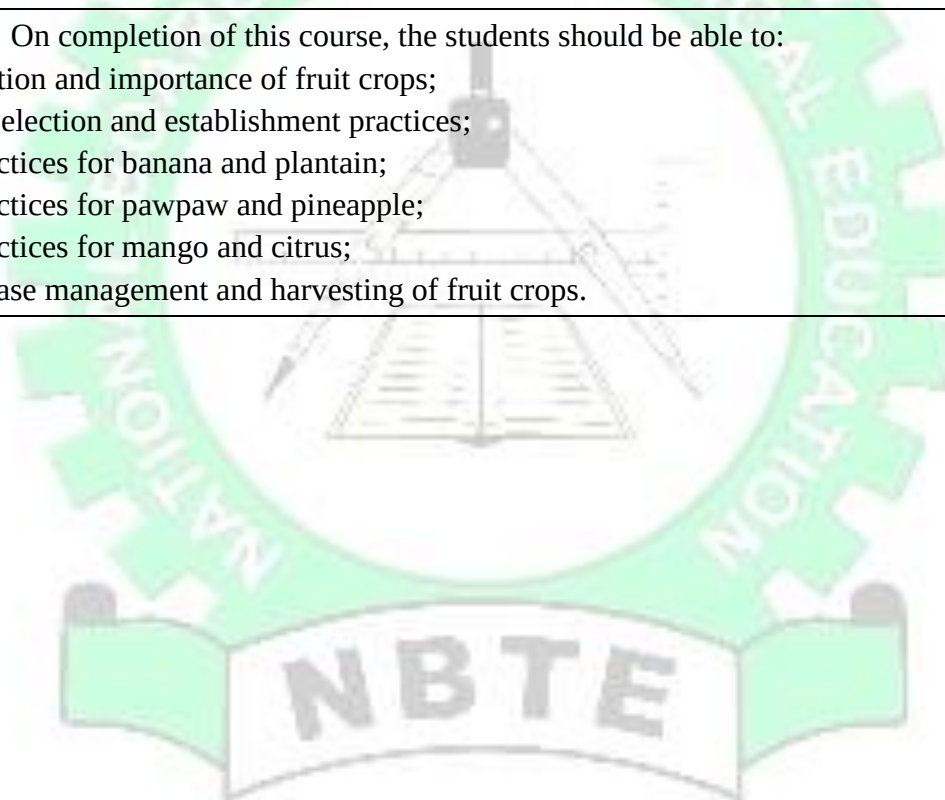
COURSE ASSESSMENT:

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



FRUIT CROP PRODUCTION I

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: FRUIT CROP PRODUCTION I	COURSE CODE: HOT 115	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills in the production of common fruit crops in Nigeria.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the classification and importance of fruit crops; 2.0 Understand orchard site selection and establishment practices; 3.0 Know the production practices for banana and plantain; 4.0 Know the production practices for pawpaw and pineapple; 5.0 Know the production practices for mango and citrus; 6.0 Understand pest and disease management and harvesting of fruit crops.		



PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: FRUIT CROP PRODUCTION I		COURSE CODE: HOT 115		CONTACT HOURS: 3 HOURS/WEEK		
		CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK		
YEAR: I SEMESTER: I		PREREQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills in the production of common fruit crops in Nigeria.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Understand the classification and importance of fruit crops						
1 – 2	1.1 Explain botanical classification of fruits. 1.2 Explain classification of fruits by climate. 1.3 Explain the difference between climacteric and non-climacteric fruits. 1.4 List producing areas of the various fruit tree crops in Nigeria. 1.5 Explain fruit crops production 1.6 Describe the nutritional and	- Discuss botanical classification of fruits with the aid of diagrams and charts. - Discuss classification of fruits by climate. - Describe the difference between climacteric and non-climacteric fruits with examples. - Discuss the producing areas of the various fruit	Food composition chart, botanical classification chart, climatic classification chart, projector. Whiteboard, markers, slides, Computer, agricultural maps of Nigeria	- Identify fruit crops and record local name, botanical name and fruit type. - Classify Nigerian fruit crops by botanical type, climate class and climacteric response - Prepare a career pathway chart showing five careers in the fruit crop sub-sector.	Guide students to: - Identify fruit crops and record local name, botanical name and fruit type. - Classify Nigerian fruit crops by botanical type, climate class and climacteric response - Prepare a career pathway chart showing five careers in the fruit crop sub-	College farm or orchard, Samples of fruit crops. classification table/chart, career pathway template.

	economic importance of fruit crops in Nigeria.	tree crops in Nigeria. • Explain fruit crops production • Discuss the nutritional and economic importance of fruit crops in Nigeria.			sector.	
General Objective 2.0: Understand orchard site selection and establishment practices						
3 – 5	2.1 State the criteria for site selection of an orchard. 2.2 Describe orchard layout systems. 2.3 Describe land preparation. 2.4 Highlight the procedure for planting a fruit tree seedling. 2.5 Explain post-planting cultural management practices.	• Explain the criteria for site selection of an orchard: - Soil depth, - Drainage - Water, - Slope, - Market access, etc. • Discuss orchard layout systems: - Square, - Rectangular - Triangular - Contour planting. • Explain land	Site evaluation form, layout diagrams, land preparation guide, planting guide, Whiteboard, marker, slides and projector, laptop computer.	• Evaluate the suitability of the college farmland for fruit crops cultivation • Mark out and stake planting points for fruit crops at appropriate spacing using the most suitable layout systems. • Demonstrate planting of fruit crops seedlings • Demonstrate post-planting cultural management practices: - Mulching, - Weeding,	Guide students to: • Evaluate the suitability of the college farmland for fruit crops cultivation • Mark out and stake planting points for fruit crops at appropriate spacing using the most suitable layout system • Demonstrate planting of fruit crops seedlings • Demonstrate post-planting	Site evaluation form, measuring tape, pegs, spades, compost, fertiliser, fruit tree seedlings, mulch material, field nursery poly bags.

		preparation: - Clearing, - Deep tillage, - Marking out, - Hole digging - Soil improvement. • Enumerate the procedure for planting fruit tree seedling: - Nursery establishment - Transplanting, etc. • Explain post-planting cultural management practices: - Mulching, - Weeding, - Pruning, - Manuring, - Fertilizer application, - Pest and disease, etc.		- Pruning, etc.	cultural management practices: - Mulching, - Weeding, - Pruning, etc.	
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General Objective 3.0: Know the production practices for banana and plantain

6 – 7	3.1 Describe the botany of banana and plantain. 3.2 Describe agronomic requirements of banana and plantain. 3.3 Describe the propagation of banana and plantain. 3.4 Describe their cultural practices. 3.5 Describe their maturity indices, harvesting technique, management, pests and diseases.	• Explain banana and plantain botany: - Corm, - Pseudo stem, - Bunch and mat system. • Discuss agronomic requirements of banana and plantain: - Soil, - pH, - Rainfall, - Temperature etc. • Explain the propagation of banana and plantain: - Land preparation - Sword sucker selection, - Corm pairing, - Planting, - Spacing	Banana botany diagram, pest and disease management, charts, Whiteboard, markers, slides, Projector and Computer	• Prepare sword suckers • Plant suckers at recommended spacing • Carry out cultural practices: - Desuckering - Propping, - Fertilizer application - Pest and disease control • Harvest a bunch at correct maturity	Guide students to: • Prepare sword suckers • Plant suckers at recommended spacing • Carry out cultural practices: - Desuckering - Propping, - Fertilizer application - Pest and disease control • Harvest a bunch at correct maturity	Corm paring tool, machete, spade, compost, fertiliser, weighing scale, field, Pest and disease specimens.
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		- Describe their cultural practices: - Spacing, - Fertilizer, - Desuckering - Propping, etc. - Explain their maturity indices, harvesting technique, management, pests and diseases.				
General Objective 4.0: Know the production practices for pawpaw and pineapple						
8 – 10	4.1 Describe the botany of pawpaw. 4.2 Describe the agronomic requirements of pawpaw. 4.3 Explain pawpaw production. 4.4 Describe pests and diseases of pawpaw. 4.5 Describe maturity indices and harvesting of pawpaw.	- Explain the botany of pawpaw: - Sex types, - Pollination - Explain the agronomic requirements of pawpaw: - Soil, - Temperature, - Rainfall, etc.	Pawpaw flower photographs, pest and disease charts, pineapple diagram, crown preparation guide, Whiteboard, markers, slides, Projector, Computer	- Raise pawpaw seedlings - Transplant pawpaw seedlings in the field. - Identify sex type of pawpaw at first flowering - Plant pineapple crowns on a prepared bed - Conduct scouting of the	Guide students to: - Raise pawpaw seedlings - Transplant pawpaw seedlings in the field. - Identify sex type of pawpaw at first flowering; - Plant pineapple crowns on a prepared bed - Scout the pawpaw plot for pests and	Pawpaw seeds, nursery bags, growing medium, pineapple crowns, hoes, fertiliser, scouting form, pest and disease specimens.

	4.6 Describe pineapple botany 4.7 Describe the agronomic requirements of pineapple. 4.8 Describe pineapple production.	• Discuss pawpaw production: - Land preparation - Nursery raising, - Transplanting, - Sex identification - Thinning, - Weeding, - Fertilizer application, etc. • Discuss pests and diseases of pawpaw: - Mealy bug, - Ring spot virus - Root rot. • Explain maturity indices and harvesting of pawpaw. • Explain pineapple botany • Discuss the agronomic requirements of pineapple:		pawpaw plot for pests and diseases	diseases;	
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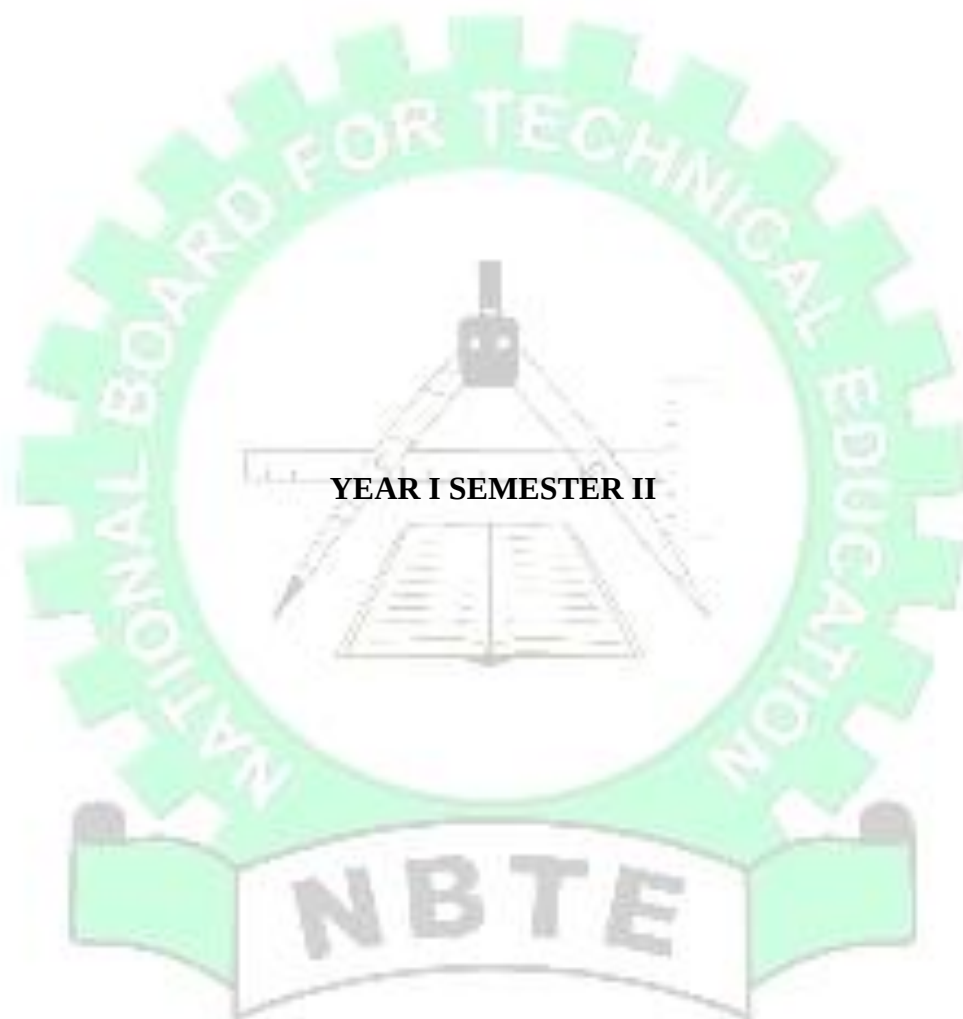
		- Soil, - pH - Climate. • Explain pineapple production: - Land preparation, - Planting material types, - Planting, - Fertilizing, - Weeding, - Pest and disease, control - Harvesting.				
General Objective 5.0: Know the production practices for mango and citrus						
11 – 13	5.1 Describe the botany of mango. 5.2 List the common varieties of mango in Nigeria. 5.3 Describe mango agronomic requirements. 5.4 Describe mango propagation by budding and grafting.	• Explain the botany of mango • Explain the common varieties of mango in Nigeria. • Discuss mango agronomic requirements: - Soil, - Temperature	Mango variety samples photographs, citrus variety photographs, pruning diagrams, pest and disease management chart, Whiteboard, markers,	• Identify varieties of mango and citrus • Carry out budding on citrus rootstocks • Carry out grafting on mango rootstocks • Apply fertiliser to mango or citrus trees by ring method	Guide students to: • Identify varieties of mango and citrus • Carry out budding on citrus rootstocks • Carry out grafting on mango rootstocks • Apply fertiliser to	Samples of citrus and mango species/varieties rootstocks, scion wood, budding and grafting tools, fertiliser, pruning shears, harvesting tools scouting form.

5.5 Describe production practices of mango. 5.6 Describe maturity indices and harvesting practices of mango. 5.7 Describe pest and disease management in mango. 5.8 List citrus species grown in Nigeria with their local and botanical names. 5.9 Describe citrus agronomic requirements 5.10 Enumerate the different citrus species 5.11 Describe citrus production Describe cultural management practices in citrus production. 5.12 Describe pruning objectives and techniques for mango and citrus 5.13 Describe common pests and	- Rainfall, - Humidity, etc. • Explain mango propagation by budding and grafting. • Explain production practices of mango; - Land preparation, - Mark out, - Holing, - Transplanting - Weeding, etc. • Discuss maturity indices and harvesting practices of mango. • Explain pest and disease management in mango. • List citrus species grown in Nigeria with their local and botanical names.	slides, Projector Computer	• Carry out pruning of young mango or citrus trees • Conduct scouting of mango or citrus trees for pests and diseases	mango or citrus trees by ring method • Carry out pruning of young mango or citrus trees • Conduct scouting of mango or citrus trees for pests and diseases	
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	diseases and their control. 5.14 Describe citrus maturity indices and harvesting technique.	• Explain citrus agronomic requirements; - Soil, - Temperature, - Rainfall, - Humidity, etc. • List the different citrus species: - Core Ancestral Species, - Oranges (Hybrid Group), - Mandarins - Tangerines - Lemon and Lime (Hybrid Group), - Grapefruits - Specialised Hybrids. • Explain citrus production: - Budding and grafting, - Spacing - Fertiliser application.				
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		• Discuss cultural management practices in citrus production. • Explain pruning objectives and techniques for mango and citrus, • List common pests and diseases and their control. • Explain citrus maturity indices and harvesting technique				
General Objective 6.0: Understand pest and disease management and harvesting of fruit crops						
14 – 15	6.1 Explain types of fruit crop pests. 6.2 Describe fruit crop diseases. 6.3 Describe cultural control and integrated management. 6.4 Describe maturity indices for mango, citrus, pawpaw and banana.	• Describe types of fruit crop pests: - Fruit flies, - Mealy bugs, - Scale insects, - Trunk borers, etc. • Explain fruit crop diseases: - Anthracnose - Gummosis, - Black sigatoka, - Ringspot virus, etc.	Pest and disease chart, fruit bagging guide, maturity index chart, Projector, Computer, journals.	• Conduct scouting of fruit tree for pest or disease • Assess severity and recommended control. • Bag developing mangoes or citrus fruits • Compare bagged versus unbagged periodically • Apply botanical extract to a pest-	Guide students to: • Conduct scouting of fruit tree for pest or disease • Assess severity and recommended control. • Bag developing mangoes or citrus fruits • Compare bagged versus unbagged periodically	sweep nets, hand lens, fruit bagging materials, neem leaves, extraction equipment, harvesting tools, grading containers, packaging materials, weighing scale.

	6.5 Describe post-harvest operations for fresh fruit.	- Describe cultural control and integrated management: - Sanitation, - Biological control, - Fruit bagging - Targeted spraying. - Explain maturity indices for mango, citrus, pawpaw and banana. - Discuss post-harvest operations: - Cleaning, - Sorting, - Grading, - Packaging - Storage for fresh fruit	affected tree - Harvest fruit at correct maturity - Sort and grade harvested fruit into two quality classes - Package each grade with label for the market	- Apply botanical extract to a pest-affected tree - Harvest fruit at correct maturity - Sort and grade harvested fruit into two quality classes - Package and label each grade for the market	
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%					



VEGETABLE CROP PRODUCTION II

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY			
COURSE TITLE: VEGETABLE CROP PRODUCTION II		COURSE CODE: HOT 121	CONTACT HOURS: 3 HOURS/WEEK
		CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I	SEMESTER: II	PREREQUISITE: HOT 114	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in the production of solanaceous, cucurbit and indigenous vegetables in Nigeria.			
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the production of solanaceous vegetables; 2.0 Know production practices for cucurbit vegetables; 3.0 Know production practices for indigenous and under-utilized vegetables; 4.0 Understand protected cropping for vegetable production; 5.0 Understand irrigation and fertigation in vegetable production; 6.0 Understand post-harvest management for vegetable crops.			

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: VEGETABLE CROP PRODUCTION II			COURSE CODE: HOT 121		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PREREQUISITE: HOT 114		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in the production of solanaceous, cucurbit and indigenous vegetables in Nigeria.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Understand the production of solanaceous vegetables						
1 – 3	1.1 List common solanaceous vegetables with their local and botanical names. 1.2 Explain common cultivars of each crop above. 1.3 Describe the agronomic requirements of solanaceous vegetables. 1.4 Describe production practices of solanaceous vegetables. 1.5 Describe cultural practices for solanaceous vegetables.	- List common solanaceous vegetables with their local and botanical names: - Tomato, - Pepper, - Garden egg, - Potato - Explain common cultivars of each crop above. - Discuss the agronomic requirements of	Solanaceous vegetable pictures, pest and disease charts, projector, white board, internet, computers.	- Identify common solanaceous vegetables and their varieties. - Carry out seed bed preparation and sowing. - Carry out transplanting and staking of at least one solanaceous vegetable of choice. - Apply fertilizer using appropriate methods.	Guide students to: - Identify common solanaceous vegetables and their varieties. - Carry out seed bed preparation and sowing. - Carry out transplanting and staking of at least one solanaceous vegetable of choice. - Apply fertilizer using appropriate	Tomato seeds, nursery trays, bamboo stakes, fertiliser, scouting form, harvesting containers, weighing scale.

	1.6 Describe common pests and diseases of solanaceous vegetables and their management. 1.7 Describe maturity indices and harvesting practices of solanaceous vegetables	solanaceous vegetables: - Soil, - pH, - Temperature, - Rainfall - Water. • Explain production practices of solanaceous vegetables: - Land preparation, - Nursery production - Transplanting • Explain cultural practices for solanaceous vegetables: - Weeding, - Staking, - Mulching, - Irrigation; - Fertiliser application: (basal dressing, top-dressing and foliar feeding		• Observe crops for pest and disease attack • Recommend appropriate control measure. • Harvest crops • Calculate yield of crops.	methods. • Observe crops for pest and disease attack • Recommend appropriate control measure. • Harvest crops Calculate yield of crops.	
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		schedules), etc. • Explain common pests and diseases of solanaceous vegetables and their management. • Discuss maturity indices and harvesting practices of solanaceous vegetables				
General Objective 2.0: Know production practices for cucurbit vegetables						
4-6	2.1 List common cucurbit vegetables with their local and botanical names. 2.2 State the common cultivars of each of the crops above. 2.3 Describe the agronomic requirements of cucurbits. 2.4 Describe cucurbit production practices. 2.5 Describe pollination management. 2.6 Describe common pests and diseases of cucurbits and their	• Discuss common cucurbit vegetables with their local and botanical names: - Cucumber, - Watermelon, - Melon - Pumpkin. • Describe the common cultivars of each of the crops above. • Explain the agronomic requirements of cucurbits: - Soil, - pH, - Temperature	Cucurbit sample pictures, vine training guide, male and flower identification chart, pest and disease charts, projector, white board, internet, computers.	• Identify common cucurbit vegetables and their varieties. • Plant cucurbit seeds at correct spacing. • Carry out vine training and pruning. • Identify male and female flowers on the crop. • Apply fertilizer at the correct stages • Harvest at correct maturity	Guide students to: • Identify common cucurbit vegetables and their varieties. • Plant cucurbit seeds at correct spacing. • Carry out vine training and pruning. • Identify male and female flowers on the crop. • Apply fertilizer at the correct stages • Harvest at correct	Cucurbit seeds, hoes, fertilizer, scouting form, harvesting containers, weighing scale.

	management. 2.7 Explain maturity indices and harvesting practices in curcubit.	- Rainfall, etc. • Explain cucurbit production practices: - Land preparation, - Planting, - Training, - Staking, - Fertilizer application, etc. • Describe pollination management: - Male and female flower identification - Bee attraction. • Discuss common pests and diseases of cucurbits and their management. • Describe maturity indices and harvesting practices in curcubit.		• Calculate yield	maturity • Calculate yield	
General Objective 3.0: Know production practices for indigenous and under-utilized vegetables						
7-8	3.1 List common indigenous vegetables. 3.2 State the nutritional and economic importance of	• Describe common indigenous vegetables: - Fluted	Indigenous vegetable sample pictures, nutritional	• Plant fluted pumpkin at correct spacing • Train vines on stakes. • Propagate moringa	Guide students to: • Plant fluted pumpkin at correct spacing	Fluted pumpkin seeds, moringa seeds or

	indigenous vegetables in Nigeria. 3.3 Describe the agronomic requirements of indigenous and underutilized vegetables. 3.4 Explain production practices of indigenous and underutilized vegetables. 3.5 Describe post-harvest handling and marketing of indigenous vegetables	pumpkin, - African eggplant, - Bitter leaf - Moringa. • Discuss the nutritional and economic importance of indigenous vegetables in Nigeria. • Explain the agronomic requirements of indigenous and underutilized vegetables: - Soil, - Temperature, - Rainfall, etc. • Explain production practices of indigenous and underutilized vegetables: - Land preparation, - Planting - Cultural practices (weeding, staking, training,	data, fluted pumpkin production guide, moringa production guide, projector, white board.	from seed or cuttings. • Carry out pruning of moringa at correct height • Harvest fluted pumpkin leaves and fruits at correct maturity. • Package and price indigenous vegetables for sale • Record packaging method and selling price per unit.	• Train vines on stakes. • Propagate moringa from seed or cuttings. • Carry out pruning of moringa at correct height • Harvest fluted pumpkin leaves and fruits at correct maturity. • Package and price indigenous vegetables for sale • Record packaging method and selling price per unit.	cuttings, stakes, pruning tools, packaging materials.
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		harvesting, etc.) • Explain post-harvest handling and marketing of indigenous vegetables				
General Objective 4.0: Understand protected cropping for vegetable production						
9-10	4.1 Explain types of protected cropping structures. 4.2 List construction materials for protected structures 4.3 State the advantages of protected cropping over open field production. 4.4 Describe crop management under protected. 4.5 Describe suitable crops for protected cropping in the Nigerian climate. 4.6 Describe the economics of protected cropping: cost of structures and returns.	• Describe types of protected cropping structures: - Shade net houses, - Rain shelters - Low tunnels. • Explain construction materials for protected structures • Discuss the advantages of protected cropping over open field production. • Explain crop management under protected cropping: - Watering, - Ventilation - Pest control. • Explain suitable	Protected structure charts, cost-benefit guide, crop suitability list, projector, white marker boards, internet, computers.	• Conduct a Visit to any available protected cropping structure • Inspect a shade net house or green house • Erect a low tunnel over a vegetable bed • Take note of the dimension and materials used. • Manage a crop under protected structure • Carry out watering, ventilation and pest observations. • Compare plant growth under the structure with	Guide students to: • Conduct a Visit to any available protected cropping structure • Inspect a shade net house or green house • Erect a low tunnel over a vegetable bed • Take note of the dimension and materials used. • Manage a crop under protected structure • Carry out watering, ventilation and pest observations. • Compare plant	Low tunnel materials, polythene or shade netting, measuring tape, observation sheet, cost-benefit template.

		crops for protected cropping in the Nigerian climate. - Discuss the economics of protected cropping: - Cost of structures - Returns		plants in the open field - Record height and leaf colour for both - Prepare a simple cost-benefit estimate for a 10 m x 5 m shade net house.	growth under the structure with plants in the open field - Record height and leaf colour for both - Prepare a simple cost-benefit estimate for a 10 m x 5 m shade net house.	
General Objective 5.0: Understand irrigation and fertigation in vegetable production						
11-12	5.1 Describe irrigation methods used in vegetable production. 5.2 Explain the determination of irrigation scheduling. 5.3 Define fertigation 5.4 List various fertilisers suitable for fertigation. 5.5 State the advantages of fertigation over soil application. 5.6 Describe the installation and operation of a simple drip irrigation system 5.7 Describe water quality requirements for	- Discuss irrigation methods used in vegetable production: - Drip, - Sprinkler - Furrow irrigation. - Describe the determination of irrigation scheduling: - Crop water requirement - Soil moisture monitoring.	Irrigation method charts, soil moisture guide, projector, Internet, computers.	- Install a simple drip irrigation system on a vegetable bed. - Record layout, emitter spacing and operating pressure. - Operate the drip system for one irrigation cycle. - Prepare a fertigation solution - Apply through the drip system - Monitor soil moisture daily for a period of time using	Guide students to: - Install a simple drip irrigation system on a vegetable bed. - Record layout, emitter spacing and operating pressure. - Operate the drip system for one irrigation cycle. - Prepare a fertigation solution - Apply through the	Drip irrigation kit, water-soluble fertiliser, measuring containers, feel test guide.

	vegetable irrigation	• Explain fertigation • Explain various fertilisers suitable for fertigation. • Explain the advantages of fertigation over soil application. • Explain the installation and operation of a simple drip irrigation system • Explain water quality requirements for vegetable irrigation		the feel test • Compare growth of drip-irrigated plants with furrow-irrigated plants • Record height and yield.	drip system • Monitor soil moisture daily for a period of time using the feel test • Compare growth of drip-irrigated plants with furrow-irrigated plants • Record height and yield.	
General Objective 6.0: Understand post-harvest management for vegetable crops						
13-15	6.1 Describe the causes and extent of post-harvest losses in Nigerian vegetable supply chain. 6.2 Describe grading and packaging standards for fresh vegetables for local and export markets. 6.3 Describe value addition options for vegetables. 6.4 Describe cold chain	• Explain the causes and extent of post-harvest losses in Nigerian vegetable supply chain. • Discuss grading and packaging standards for fresh vegetables for local and export markets. • Explain value	Post-harvest loss charts, cold chain diagram, projector, white marker board, internet, computers.	• Sort and grade harvested vegetables to local and export standards. • Dry a batch of vegetables (pepper or tomato) using sun drying or a drier. • Record starting weight, final weight and moisture loss.	Guide students to: • Sort and grade harvested vegetables to local and export standards. • Dry a batch of vegetables (pepper or tomato) using sun drying or a drier.	Harvested vegetables, grading containers, drying trays or drier, paste making equipment, FIFO record template, weighing

COURSE ASSESSMENT:

Course work:	10%
Test/Assignments:	10%
Practical:	40%

Examination:	40%
Total:	100%



IRRIGATION AND WATER MANAGEMENT IN HORTICULTURE

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: IRRIGATION AND WATER MANAGEMENT IN HORTICULTURE	COURSE CODE: HOT 122	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in irrigation systems design, operation and management for horticultural crop production.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know water requirements of horticultural crops; 2.0 Know the types and components of irrigation systems; 3.0 Know drip irrigation installation and management; 4.0 Know sprinkler irrigation installation and management; 5.0 Know water quality assessment and treatment; 6.0 Understand irrigation scheduling and water use efficiency.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: IRRIGATION AND WATER MANAGEMENT IN HORTICULTURE			COURSE CODE: HOT 122		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PREREQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in irrigation systems design, operation and management for horticultural crops production.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Know water requirements of horticultural crops						
1 – 2	1.1 Highlight the roles of water in plant growth. 1.2 Explain factors affecting crop water requirement. 1.3 Define evapotranspiration 1.4 Explain the estimation of evapotranspiration for irrigation scheduling. 1.5 Explain water stress and water logging. 1.6 Describe signs of water stress and waterlogging in common horticultural	- Explain the roles of water in plant growth: - Nutrient uptake and mobility, - Photosynthesis, - Transpiration - Cell turgidity. - Discuss factors affecting crop water requirement: - Crop type, - Growth stage, - Temperature - Humidity, etc. - Explain	Plant water role chart, crop water requirement table, evapotranspiration guide, stress and waterlogging plant charts, white board, projector, internet, computers.	- Identify signs of water stress and waterlogging on horticultural crops - Carry out feel test to assess soil moisture on the college farm - Carry out daily monitoring of temperature and humidity - Estimate evapotranspiration from the above monitoring.	Guide students to: - Identify signs of water stress and waterlogging on horticultural crops - Carry out feel test to assess soil moisture on the college farm; - Carry out daily monitoring of temperature and humidity - Estimate evapotranspiration from the above	College farm crops, feel test guide, temperature and humidity recording form, crop water requirement table, field notebooks, weather station

	crops. 1.7 Describe the water requirements of horticultural crops at each growth stage	evapotranspiration - Describe the estimation of evapotranspiration for irrigation scheduling. - Discuss water stress and water logging. - Explain signs of water stress and waterlogging in common horticultural crops. - Explain the water requirements of horticultural crops at each growth stage		- Calculate and compare crop water requirement for horticultural crops at transplanting, vegetative and fruiting stages. - Prepare a water requirement schedule for horticultural crop from planting to harvest	monitoring. - Calculate and compare crop water requirement for horticultural crops at transplanting, vegetative and fruiting stages. - Prepare a water requirement schedule for horticultural crop from planting to harvest	
General Objective 2.0: Know the types and components of irrigation systems						
3-5	2.1 Describe surface irrigation methods. 2.2 Describe sprinkler irrigation 2.3 Explain its components, types and suitable crops. 2.4 Describe drip irrigation, 2.5 Explain its	- Discuss surface irrigation methods: - Furrow, - Border strip - Basin irrigation. - Explain sprinkler irrigation - Describe its components, types	Irrigation method charts, comparison table, maintenance guide, projector, white board, computer, internet.	- Identify all components of the college farm drip or sprinkler system. - State the function of each component - Set up a furrow irrigation system on a vegetable bed - Record furrow	Guide students to: - Identify all components of the college farm drip or sprinkler system. - State the function of each component - Set up a furrow	College farm irrigation system, measuring cylinder, stopwatch, maintenance schedule template, drip hose,

	components, types of emitters and suitable crops. 2.6 Compare irrigation methods by water use efficiency, cost and suitability for Nigeria. 2.7 Explain maintenance of each irrigation system type.	and suitable crops. • Explain drip irrigation, • Discuss its components, types of emitters and suitable crops. • Distinguish irrigation methods by water use efficiency, cost and suitability for Nigeria. • Describe maintenance of each irrigation system type.		dimensions, spacing and water flow. • Carry out flushing and inspection of drip irrigation system. • Observe any blocked emitters or leakages • Suggest maintenance action. • Compute the water application rate of three drip emitters using a measuring cylinder and stopwatch. • Prepare a daily, weekly and monthly maintenance schedule for a drip irrigation system. • Prepare irrigation schedules.	irrigation system on a vegetable bed • Record furrow dimensions, spacing and water flow. • Carry out flushing and inspection of drip irrigation system. • Observe any blocked emitters or leakages • Suggest maintenance action. • Compute the water application rate of three drip emitters using a measuring cylinder and stopwatch. • Prepare a daily, weekly and monthly maintenance schedule for a drip irrigation system. • Prepare irrigation	portable, sprinkler head, nozzles, emitters.
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					schedules.	
General Objective 3.0: Know drip irrigation installation and management						
6 -8	3.1 Describe the design steps for a simple drip irrigation system. 3.2 Describe installation sequence. 3.3 Describe drip system operation. 3.4 Explain fertigation through a drip system. 3.5 Highlight common problems of drip irrigation system. 3.6 State the solutions of each problem.	• Explain the design steps for a simple drip irrigation system: - Crop layout, - Emitter spacing, - Pipe sizing, etc. • Explain installation sequence: - Mainline, - Submain, - Lateral, - Emitter placement, etc. • Explain drip system operation: - Opening valves, - Flushing laterals, - Monitoring pressure, etc. • Explain fertigation through a drip system: - Injector types, - Fertiliser	Drip installation guide, problem photographs, projector, white boards, internet, computers.	• Design a drip system for a horticultural crop. • Sketch a drip layout, • Specify emitter spacing and pipe sizes. • Install the designed drip system • Operate the drip system for one irrigation cycle • Prepare a fertigation solution and inject through the system • Diagnose and solve drip system problems.	Guide students to: • Design a drip system using proper emitter spacing and pipe sizing. • Carry out installation of the designed system. • Demonstrate injector use; • Carry out fertigation • Carry out diagnosis of drip system. • Solve diagnosed problem	Drip system components, measuring tape, fertigation injector, water-soluble fertilizer, pressure gauge, field notebooks. Nozzles,

		- selection - Scheduling. - State common problems of drip irrigation system e.g. - Clogging, - Pressure loss, - UV degradation - Highlight the solutions of each problem.				
General Objective 4.0: Know sprinkler irrigation installation and management						
9 -11	4.1 Describe a sprinkler system design application rate. 4.2 Describe the installation of a portable sprinkler system on a horticultural farm. 4.3 Describe sprinkler system operation and maintenance schedule. 4.4 Describe the limitations of sprinkler irrigation for some horticultural crops.	- Explain a sprinkler system design: - Spacing, - Operating pressure - Application rate. - Explain the installation of a portable sprinkler system on a horticultural farm. - Explain sprinkler system operation and maintenance schedule: - Flushing	Installation guide, cost and efficiency comparison table, projector, internet, white board.	- Assemble a portable sprinkler system on a vegetable bed. - Install the assembled system. - Operate the system for one cycle. - Measure application rate using catch cans, - Record volume per can. - Calculate distribution uniformity of the sprinkler system using catch can readings.	Guide students to: - Assemble a portable sprinkler system on a vegetable bed. - Install the assembled system. - Operate the system for one cycle. - Measure application rate using catch cans, Record volume per can. - Calculate	Portable sprinkler system, catch cans, measuring cylinder, comparison table template.

	4.5 Compare the cost and water use efficiency of drip and sprinkler systems	- Nozzle checks. • Discuss the limitations of sprinkler irrigation for some horticultural crops. • Compare the cost and water use efficiency of drip and sprinkler systems		• Carry out routine maintenance: - Checking of nozzles, - Checking of flush filters - Inspection of connections • Prepare a comparison table of drip versus sprinkler for horticultural crops on the college farm	distribution uniformity of the sprinkler system using catch can readings. • Carry out routine maintenance: - Checking of nozzles, - Checking of flush filters - Inspection of connections • Prepare a comparison table of drip versus sprinkler for horticultural crops on the college farm	
General Objective 5.0: Know water quality assessment and treatment						
12 - 13	5.1 Highlight water quality parameters important for irrigation. 5.2 Explain the effect of poor water quality on crops and irrigation equipment.	• Explain water quality parameters important for irrigation: - pH, - EC, - Turbidity - Heavy metals. • Discuss the effect of	Water quality reference table, Projector, white board, internet, computer.	• Collect irrigation water samples from different sources. • Record source, colour and smell observed for each • Test for pH and EC	Guide students to: • Collect irrigation water samples from different sources. • Record source, colour and smell	Water sample containers, pH meter, EC meter, sand filter, chlorine, water quality

	5.3 Describe simple water quality tests that can be done on-farm. 5.4 State water treatment methods. 5.5 Describe water sources used for horticultural irrigation in Nigeria 5.6 Explain the quality risks of the various water sources.	poor water quality on crops and irrigation equipment. • Explain simple water quality tests that can be done on-farm. • Explain water treatment methods: - Filtration, - Chlorination - Settling. • Discuss water sources used for horticultural irrigation in Nigeria • Discuss the quality risks of the various water sources.		of each water sample. • Compare results with recommended levels for irrigation • Carry out a sand filter operation. • Record filter dimensions, media used and flow rate before and after. • Prepare a chlorine solution at the correct rate for water treatment • Record rate, volume and contact time. • Carry out water quality report for the college farm • Record all test results • Recommend treatment where needed	observed for each • Test for pH and EC of each water sample. • Compare results with recommended levels for irrigation • Carry out a sand filter operation. • Record filter dimensions, media used and flow rate before and after. • Prepare a chlorine solution at the correct rate for water treatment; • Record rate, volume and contact time. • Carry out water quality report for the college farm • Record all test results	report template.
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					Recommend treatment where needed	
General Objective 6.0: Know irrigation scheduling and water use efficiency						
14 – 15	6.1 Describe irrigation scheduling 6.2 Explain its importance in reducing water waste. 6.3 Describe methods of irrigation scheduling. 6.4 Describe water use efficiency. 6.5 Describe strategies to improve it. 6.6 Describe the role of mulching, cover cropping and minimum tillage in reducing irrigation demand. 6.7 Describe how to prepare an irrigation management plan for a horticultural farm	- Explain irrigation scheduling - Discuss its importance in reducing water waste. - Discuss methods of irrigation scheduling: - Calendar-based, - Soil moisture-based - ET-based. - Describe water use efficiency: - Definition, - Formula - Explain strategies to improve it. - Explain the role of mulching, cover cropping and minimum tillage in reducing irrigation demand. - Explain how to prepare an irrigation	Irrigation scheduling guide, soil management photographs, irrigation management plan template, projector.	- Carry out calendar-based irrigation schedule for horticultural crop - Monitor soil moisture for a period of time using a moisture meter or feel test - Calculate water use efficiency for a drip-irrigated plot versus a furrow-irrigated plot - Record all steps - Apply mulch to a vegetable bed - Monitor its effect on irrigation frequency for period of time - Record observations - Prepare a full irrigation management plan for the college farm specifying system, schedule, fertilizer	Guide students to: - Carry out calendar-based irrigation schedule for horticultural crop - Monitor soil moisture for a period of time using a moisture meter or feel test - Calculate water use efficiency for a drip-irrigated plot versus a furrow-irrigated plot - Record all steps - Apply mulch to a vegetable bed - Monitor its effect on irrigation frequency for period of time - Record	Irrigation schedule template, moisture meter or feel test guide, WUE calculation worksheet, mulch materials, irrigation management plan template, calculator.

		management plan for a horticultural farm		and monitoring.	observations • Prepare a full irrigation management plan for the college farm specifying system, schedule, fertilizer and monitoring.	
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COURSE ASSESSMENT:

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

PEST AND DISEASE MANAGEMENT IN HORTICULTURE**PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY**

COURSE TITLE: PEST AND DISEASE MANAGEMENT IN HORTICULTURE	COURSE CODE: HOT 123	CONTACT HOURS: 3 HOURS/WEEK	
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK	

GOAL: This course is designed to equip students with knowledge and skills in identification, monitoring and integrated management of pests and diseases of horticultural crops.

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

- 1.0 Understand the classification and importance of horticultural pests;
- 2.0 Understand the classification and importance of horticultural diseases;
- 3.0 Know pest and disease scouting and monitoring methods;
- 4.0 Know different types of control methods;
- 5.0 Know various classification of pesticide, method of application and safety;
- 6.0 Understand integrated pest management (IPM) in horticultural production.

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: PEST AND DISEASE MANAGEMENT IN HORTICULTURE		COURSE CODE: HOT 123		CONTACT HOURS: 3 HOURS/WEEK		
		CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK		
YEAR: I SEMESTER: II		PREREQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in identification, monitoring and integrated management of pests and diseases of horticultural crops.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Understand the classification and importance of horticultural pests						
1-2	1.1 Explain various types of horticultural pests. 1.2 Describe major insect pests of horticultural crops. 1.3 Describe their life cycle and damages caused. 1.4 Describe the economic threshold concept 1.5 Explain its application in pest management decisions	- Describe various types of horticultural pests: - Insects, - Mites, - Nematodes, - Birds - Rodents. - Discuss major insect pests of horticultural crops: - Aphids, w - Whitefly, - Thrips, - Fruit flies, etc. - Explain their life	Pest classification chart, life cycle charts, economic threshold guide, projector. Internet, mobile application, computer	- Identify horticultural pests by collecting and mounting pest specimen. - Identify damage caused by horticultural pest - Estimate damage - Observe pest infested horticultural plants - Describe type and level of	Guide students to: - Identify horticultural pests by collecting and mounting pest specimen. - Identify damage caused by horticultural pest - Estimate damage - Observe pest infested horticultural	Pest specimens or charts, mounting materials, damaged plant samples, economic threshold guide.

		cycle and damages caused. • Discuss the economic threshold concept • Discuss its application in pest management decisions		damage. • Determine whether pest population on crop exceeds the economic threshold;	plants • Describe type and level of damage. • Determine whether pest population on crop exceeds the economic threshold;	
General Objective 2.0: Understand the classification and importance of horticultural diseases						
3 – 4	2.1 Describe classification of horticultural diseases based on their causal organism. 2.2 Describe major diseases of horticultural crops. 2.3 Describe their symptoms. 2.4 Describe the disease triangle. 2.5 Describe the interaction between the components of the disease triangle. 2.6 Describe various means of horticultural disease spread.	• Explain classification of horticultural diseases based on their causal organism. • Discuss major diseases of horticultural crops, • Explain their symptoms: - Spots, - Blights, - Wilts, - Mosaics, - Cankers - Rots. • Discuss the disease triangle: - Host, - Pathogen, - Environment	Disease classification chart, disease, symptom identification key, disease triangle diagram, spread pathway diagram, projector, Internet, mobile application Computer	• Collect diseased plant samples from the college farm • Record disease name, crop affected • Describe symptoms. • Apply the disease triangle to disease on the college farm • Identify the host, pathogen and environmental conditions	Guide students to: • Collect diseased plant samples from the college farm • Record disease name, crop affected • Describe symptoms. • Apply the disease triangle to disease on the college farm • Identify the host, pathogen and environmental conditions • Prepare a disease identification reference album for	Disease chart, diseased plant samples, disease triangle diagram, scouting form, disease reference card template.

		• Explain the interaction between the components of the disease triangle. • Explain various means of horticultural disease spread.		• Prepare a disease identification reference album for horticultural crop diseases	horticultural crop diseases	
General Objective 3.0: Know pest and disease scouting and monitoring methods						
5 – 7	3.1 Describe systematic pest and disease scouting methods. 3.2 Describe pest and disease monitoring methods. 3.3 Explain the estimation of pest or disease incidence and severity. 3.4 Describe the recording of scouting data to make management decisions. 3.5 Explain the importance of early detection in reducing pesticide use and crop losses.	• Discuss systematic pest and disease scouting methods. • Explain pest and disease monitoring methods. • Describe the estimation of pest or disease incidence and severity. • Explain the recording of scouting data to make management decisions. • Discuss the importance of early detection in reducing pesticide use and crop losses.	Farm scouting layout chart, scouting recording form, decision-making guide, projector, internet, mobile app., Computer.	• Set up yellow sticky traps on the college farm • Record trap positions, date set and insects caught periodically. • Carry out systematic scouting of the college farm by observing all plots • Record pest or disease for each crop. • Carry out pest incidence and severity on crops • Record method used, count obtained and	Guide students to: • Set up yellow sticky traps on the college farm • Record trap positions, date set and insects caught periodically. • Carry out systematic scouting of the college farm by observing all plots • Record pest or disease for each crop. • Carry out pest incidence and severity on crops	Yellow sticky traps, systematic scouting form, incidence and severity recording form, scouting map template.

				severity rating. • Prepare a scouting map of the college farm showing pest and disease hotspots identified • Make management decisions for pests based on scouting data • Provide decision making justifications.	• Record method used, count obtained and severity rating. • Prepare a scouting map of the college farm showing pest and disease hotspots identified • Make management decisions for pests based on scouting data Provide decision making justifications.	
General Objective 4.0: Know the different types of control methods						
8 – 10	4.1 Define cultural control practices. 4.2 Define biological control practices with examples in horticulture. 4.3 Explain botanical pesticides and their target pest. 4.4 Describe the preparation of common botanical pesticides.	• Explain cultural control practices: - Crop rotation, - Farm sanitation, - Resistant varieties, etc. • Explain biological control practices with examples in horticulture:	Cultural control examples, natural enemy photographs, botanical pesticide preparation guide, Projector, Internet,	• Carry out cultural control practice on the college farm • Prepare botanical pesticides e.g. neem extract • Apply to a pest-affected crop	Guide students to: • Carry out cultural control practice on the college farm • Prepare botanical pesticides e.g. neem extract • Apply to a pest-affected crop • Observe for a	Neem leaves, Chilli, garlic extraction equipment, netting, sticky traps, pest count recording form.

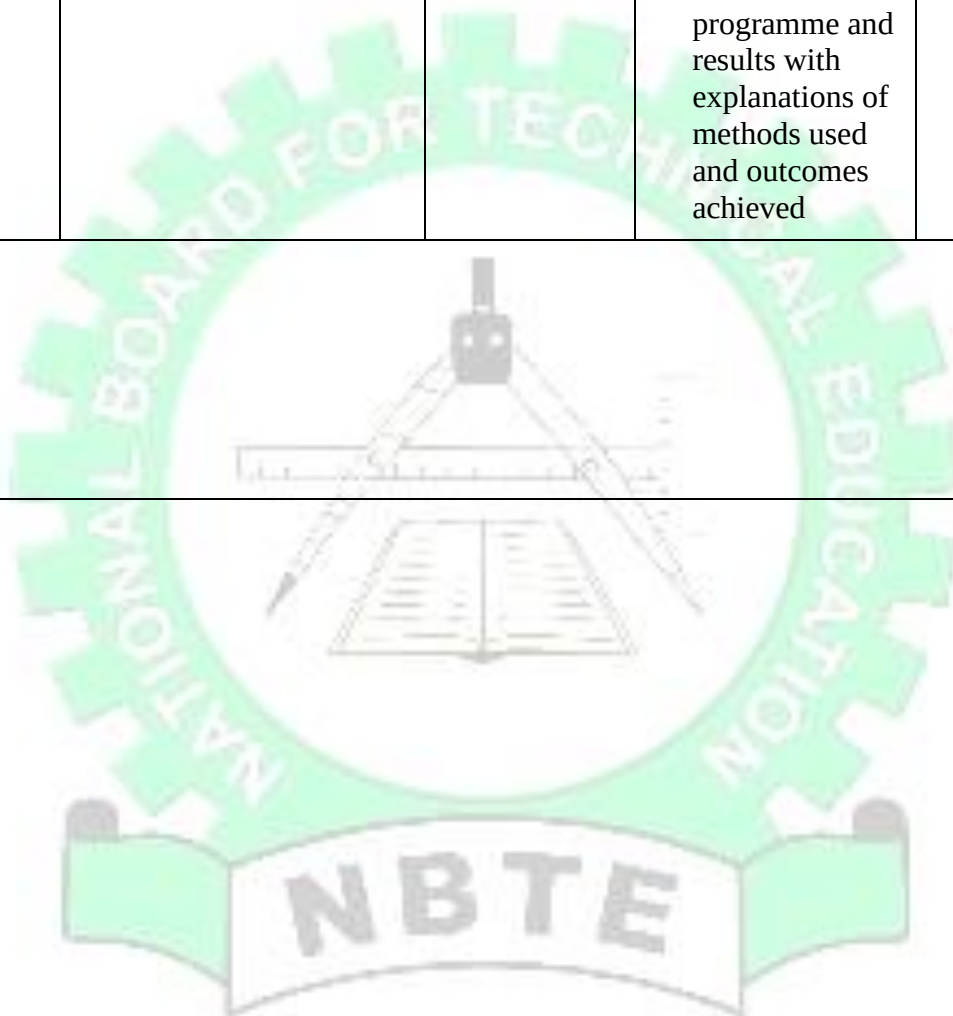
4.5 Describe the application of common botanical pesticides. 4.6 Describe the evaluation methods of cultural control methods. 4.7 Describe the effectiveness of cultural control measures. 4.8 Describe the evaluation methods of biological control measures. 4.9 Describe the effectiveness of biological control measures. 4.10 Explain the advantages and disadvantages of the various control methods	- Types of natural enemies • Discuss botanical pesticides and their target pest. • Explain the preparation of common botanical pesticides. • Explain the application of common botanical pesticides. • Explain the evaluation methods of cultural control methods. • Explain the effectiveness of cultural control measures. • Explain the evaluation methods of biological control measures. • Explain the effectiveness of biological control measures. • Discuss the advantages and disadvantages of the various control methods	Mobile app., Computer.	• Observe for a period of time. • Install physical barriers (netting or sticky traps) on college farm, • Record pests before and after installation. • Evaluate the effectiveness of biological or cultural control based on recorded result.	period of time. • Install physical barriers (netting or sticky traps) on college farm, • Record pests before and after installation. • Evaluate the effectiveness of biological or cultural control based on recorded result.	
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General Objective 5.0: Know various classification of pesticides, method of application and safety

11 – 13	5.1 Define pesticides. 5.2 Highlight the various classifications of pesticides. 5.3 Describe pesticide formulation types. 5.4 Describe the calculation of pesticide dose required for a target area. 5.5 Describe personal protective equipment for pesticide use 5.6 Describe the correct donning and doffing sequence. 5.7 Describe the pre-harvest interval, re-entry interval and safe disposal of pesticide containers.	• Explain pesticides. • List the various classifications of pesticides: - Based on mode of action, - Based on chemical grouping, - Based on formulation etc. • Explain pesticide formulation types: - EC, - WP, - SC - Granules. • Explain the calculation of pesticide dose required for a target area. • Explain personal protective equipment for pesticide use • Explain the correct donning and doffing sequence. • Discuss the pre-harvest interval, re-entry interval and safe disposal of pesticide	Pesticide classification chart, pesticide formulation samples, dosage calculation guide, PPE display set, PHI reference table, projector, internet, mobile app. Computer, white board, Marker.	• Identify pesticides according to: target pest, mode of action, formulations, etc. • Calculate the volume of pesticides needed for a target area. • Prepare a spray solution at the correct rate. • Observe the effects of various sprays on pest and diseases to make conclusions • Carry out correct donning and doffing of a full PPE set. • Complete a pesticide application record for a spray	Guide students to: • Identify pesticides according to: target pest, mode of action, formulations, etc. • Calculate the volume of pesticides needed for a target area. • Prepare a spray solution at the correct rate. • Observe the effects of various sprays on pest and diseases to make conclusions • Carry out correct donning and doffing of a full PPE set. • Complete a pesticide application record for a spray application on the college farm	Pesticide labels, Pesticide products, Measuring cylinders, PPE set, Sprayers, Water, Buckets, Field notebooks.
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		containers.		application on the college farm		
General Objective 6.0: Understand integrated pest management (IPM) in horticultural production						
14 – 15	6.1 Define Integrated Pest Management IPM. 6.2 Explain the hierarchy of control methods from prevention to chemical use. 6.3 Describe the development of an IPM programme for a horticultural crop. 6.4 Describe monitoring and evaluation of an IPM programme using pest population data. 6.5 Describe IPM adoption challenges on small-scale horticultural farms in Nigeria. 6.6 Describe food safety implications of pesticide overuse on horticultural produce.	• Explain Integrated Pest Management IPM. • Discuss the hierarchy of control methods from prevention to chemical use. • Explain the development of an IPM programme for a horticultural crop. • Explain monitoring and evaluation of an IPM programme using pest population data. • Explain IPM adoption challenges on small-scale horticultural farms in Nigeria. • Discuss food safety implications of pesticide overuse on horticultural produce.	IPM hierarchy pyramid, IPM programme template, pest count monitoring form, MRL reference table, projector Internet, mobile app., computer, White board, marker	• Develop an IPM programme for horticultural crops on the college farm. • Implement the IPM programme • Record all actions taken and pest population at each monitoring point. • Calculate pest population reduction percentage after IPM application • Evaluate the cost of IPM programme inputs versus estimated yield loss prevented • Record all	Guide students to: • Develop an IPM programme for horticultural crops on the college farm. • Implement the IPM programme, • Record all actions taken and pest population at each monitoring point. • Calculate pest population reduction percentage after IPM application • Evaluate the cost of IPM programme inputs versus estimated yield loss prevented • Record all figures • Present the IPM programme and results with explanations of	IPM programme template, pest count monitoring form, cost-benefit calculation worksheet.

				figures • Present the IPM programme and results with explanations of methods used and outcomes achieved	methods used and outcomes achieved	
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



PROTECTED HORTICULTURAL CROP PRODUCTION

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: PROTECTED HORTICULTURAL CROP PRODUCTION	COURSE CODE: HOT 124	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 2 HOURS/WEEK
YEAR: I SEMESTER: II	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and practical skills in the design, construction, operation, and management practices of protected cultivation structures.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept of controlled environment horticultural crop production; 2.0 Understand greenhouse and shade net house structures and components; 3.0 Know greenhouse design and construction; 4.0 Know horticultural crop production in greenhouse, screen house and shade house; 5.0 Understand Hydroponic system; 6.0 Understand vertical farming and urban agriculture systems; 7.0 Know climate management in controlled environments; 8.0 Understand nutrient management in controlled environment production; 9.0 Understand the economics and enterprise management of CEH.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: PROTECTED HORTICULTURAL CROP PRODUCTION			COURSE CODE: HOT 124		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 2 HOURS/WEEK	
YEAR: I SEMESTER: II			PREREQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and practical skills in the design, construction, operation, and management practices of protected cultivation structures.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Understand the concept of controlled environment horticultural (CEH) crop production						
1-2	1.1 Define controlled environment (CE) horticultural crop production. 1.2 Highlight the objectives of Controlled Environment (CE). 1.3 Describe the types of CE structures used in Nigeria and other tropical regions. 1.4 List crops commonly produced under CE in Nigeria.	- Explain controlled environment (CE) horticultural crop production. - List the objectives of Controlled Environment (CE). - Discuss the types of CE structures used in Nigeria and other tropical regions: - Greenhouses, - Shade houses, - Hydroponics - Vertical farms. - Explain crops	CEH photographs /charts, yield comparison data, CEH structure photographs /images, CEH crop list, career guide, projector, white board, computer, internet.	- Conduct a visit to any reputable horticultural farm or college farm with greenhouse or shade net house - Observe CE structure types, their components, types of crops grown and management practices - Prepare a comparison table of CEH versus open field production for a crop. - Compare yield, quality and cost differences of CEH and open field	Guide students to: - Conduct a visit to any reputable horticultural farm or college farm with greenhouse or shade net house - Observe CE structure types, their components, types of crops grown and management practices - Prepare a comparison table of CEH versus open	Nearby greenhouse or shade net house, comparison table template, research guide, career pathway template.

	1.5 Describe the advantages of CE over open field production. 1.6 Describe career and enterprise opportunities in CEH for ND graduates in Nigeria.	commonly produced under CE in Nigeria: - Tomato, - Cucumber - Pepper - Lettuce, etc. • Discuss the advantages of CE over open field production. • Discuss career and enterprise opportunities in CEH for ND graduates in Nigeria.		production. • Prepare a career pathway chart showing four career options in the CEH sector for ND graduates	field production for a crop. • Compare yield, quality and cost differences of CEH and open field production. • Prepare a career pathway chart showing four career options in the CEH sector for ND graduates	
General Objective 2.0: Understand greenhouse, shade net house, and other structures and components						
3 – 4	2.1 Explain greenhouse types to compare materials and costs. 2.2 Describe the components of a greenhouse. 2.3 Describe shade net house types and shade net densities suitable for different crops. 2.4 Explain irrigation	• Discuss greenhouse types to compare materials and costs: - Venlo, - Tunnel - Gothic arch. • Explain the components of a greenhouse: - Frame, - Covering, - Gutters,	Greenhouse type photographs, labelled greenhouse diagram, shade net density guide, irrigation system diagram,	• Sketch and label the college CEH structure or a greenhouse visited. • Identify all major components of a greenhouse. • Measure the dimensions of the college CEH structure • Calculate the total floor area. • Identify the irrigation	Guide students to: • Sketch and label the college CEH structure or a greenhouse visited. • Identify all major components of a greenhouse. • Measure the dimensions of the college CEH structure	College CEH structure or greenhouse, sketch template, measuring tape, maintenance checklist and tools.

	in CE structures. 2.5 Describe structural maintenance requirements for greenhouses, shade houses, etc.	- Vents - Foundation. • Explain shade net house types and shade net densities suitable for different crops. • Discuss irrigation in CE structures. • Explain structural maintenance requirements for greenhouses, shade houses, etc.	maintenance schedule guide, projector.	system inside the structure, its type, components and operating condition. • Inspect the college CE structure for any maintenance needs; • Carry out simple maintenance for the college CEH structure	• Calculate the total floor area. • Identify the irrigation system inside the structure, its type, components and operating condition. • Inspect the college CE structure for any maintenance needs; • Carry out simple maintenance for the college CEH structure	
General Objective 3.0: Know greenhouse design and construction						
5	3.1 Describe greenhouse design considerations. 3.2 Describe types of covering materials in greenhouse to compare the cost and light transmission of each. 3.3 Describe the construction sequence for	• Discuss greenhouse design considerations: - Orientation, - Ventilation, - Structural load - Covering material. • Explain types of covering materials in greenhouse to compare the cost and light	Greenhouse design sketch, covering materials construction materials, guttering guide, maintenance schedule, projector, white board,	• Sketch a greenhouse design for a 50 m² production area. including orientation, vents and gutters. • Measure the college CEH structures, calculate floor area, volume estimate crop output per time. • Inspect the structure for maintenance needs	Guide students to: • Sketch a greenhouse design for a 50 m² production area. including orientation, vents and gutters. • Measure the college CEH structures, calculate floor area, volume estimate crop output per	College CEA structure, measuring tape, design template, maintenance schedule template, tools and materials for minor repair, field notebooks.

	different types of greenhouses. 3.4 Describe gutters, guttering systems and rainwater harvesting from greenhouse structures. 3.5 Describe the maintenance schedule for greenhouse structures and covering materials.	transmission of each: - Glass, - Polycarbonate - Polyethylene film. • Explain the construction sequence for different types of greenhouses. • Discuss gutters, guttering systems and rainwater harvesting from greenhouse structures. • Discuss the maintenance schedule for greenhouse structures and covering materials.	computer.	• Record findings to recommended corrective actions • Install or repair one component of the college CE structure • Prepare a five-year maintenance schedule for the college CE structure.	time. • Inspect the structure for maintenance needs • Record findings to recommended corrective actions • Install or repair one component of the college CE structure; • Prepare a five-year maintenance schedule for the college CE structure.	
General Objective 4.0: Know horticultural crop production in greenhouse, screen house and shade house.						
6 – 7	4.1 Describe substrate selection for CE production. 4.2 Describe transplanting and plant spacing for CE vegetable	• Discuss substrate selection for CE production: - Coco peat, - Perlite, - Rock wool blocks	Pest and disease chart, yield recording form, projector, white board,	• Fill growing bags with coco peat or any growing medium • Transplant one vegetable species • Record date and substrate used.	Guide students to: • Fill growing bags with coco peat or any growing medium • Transplant one vegetable species	Growing bags, coco peat or growing medium, tomato or cucumber seedlings,

	crops. 4.3 Describe training and trellising of crops in CE structures. 4.4 Describe pest and disease management specific to CE conditions. 4.5 Describe harvesting and yield recording for CEH crops.	- Growing bags. • Explain transplanting and plant spacing for CE vegetable crops. • Explain training and trellising of crops in CE structures: - String and clip systems. • Discuss pest and disease management specific to CE conditions. • Explain harvesting and yield recording for CEH crops.	computer.	• Carry out string and clip training on tomato or cucumber plants. • Carry out scouting for pests and diseases inside the CE structures • Record findings to suggest management actions. • Harvest CE-grown produce at correct maturity.	• Record date and substrate used. • Carry out string and clip training on tomato or cucumber plants. • Carry out scouting for pests and diseases inside the CE structures • Record findings to suggest management actions. • Harvest CE-grown produce at correct maturity.	string, clips, scouting form, yield recording form, production record form.
General Objective 5.0: Understand Hydroponic System						
8 – 9	5.1 Describe hydroponic systems. 5.2 Explain the components and setup of a hydroponic system. 5.3 Describe crop management in hydroponic systems. 5.4 Describe the	• Discuss hydroponic systems: - NFT, - DWC, - Ebb-and-flow - Drip-to-waste. • Describe the components and	Hydroponic system diagrams, hydroponic problem guide, projector.	• Set up a simple DWC or drip hydroponic system. • Transplant seedlings into the hydroponic system. • Monitor EC and pH of the nutrient solution for a period of time. • Observe the limitations and challenges associated with	Guide students to: • Set up a simple DWC or drip hydroponic system. • Transplant seedlings into the hydroponic system. • Monitor EC and pH of the nutrient solution for a period	Hydroponic system components, nutrient chemicals, growing medium, crop seedlings.

	limitations and common problems in hydroponic production.	setup of a hydroponic system. • Explain crop management in hydroponic systems: - Transplanting, - Training - Harvesting. • Discuss the limitations and common problems in hydroponic production: - Root disease, - Nutrient imbalance - Equipment failure		hydroponic system. • Harvest a hydroponic crop at correct maturity.	of time. • Observe the limitations and challenges associated with hydroponic system. • Harvest a hydroponic crop at correct maturity.	
General Objective 6.0: Understand vertical farming and urban agriculture systems						
10 – 11	6.1 Define vertical farming 6.2 Describe its key features. 6.3 Describe urban agriculture systems. 6.4 Describe crops suitable for vertical farming. 6.5 Describe the water	• Define vertical farming • Discuss its key features: - Stacked growing layers, - LED lighting - Precise	Vertical farming charts, suitable crop list, resource consumption data, economics case study,	• Design a simple two-tier vertical growing system for horticultural crops. • Sketch a layout listing materials needed. • Set up a small vertical growing unit using shelves and grow lights. • Grow microgreens in a	Guide students to: • Design a simple two-tier vertical growing system for horticultural crops. • Sketch a layout listing materials needed. • Set up a small vertical growing	Shelving unit, LED grow lights, growing trays, microgreen seeds or lettuce seeds, growing medium, design

	and energy requirements of vertical farming systems. 6.6 Describe the economics of vertical farming.	climate control. • Explain urban agriculture systems: - Rooftop gardens, - Container gardens - Indoor growing. • Discuss crops suitable for vertical farming: - Leafy greens, - Herbs - Microgreens. • Explain the water and energy requirements of vertical farming systems. • Discuss the economics of vertical farming: - Investment, - Operating cost - Profitability	projector, white board, computer, internet.	vertical growing system. • Carry out routine practices in the vertical system. • Calculate the yield per square meter for microgreens • Compare with open field leafy vegetable yield. • Prepare a simple cost-benefit analysis for a 4 m² vertical farm growing lettuce.	unit using shelves and grow lights. • Grow microgreens in a vertical growing system. • Carry out routine practices in the vertical system. • Calculate the yield per square meter for microgreens • Compare with open field leafy vegetable yield. • Prepare a simple cost-benefit analysis for a 4 m² vertical farm growing lettuce.	template, cost-benefit template.
General Objective 7.0: Know climate management in controlled environments						
12 – 13	7.1 Describe climate parameters	• Discuss climate parameters	Climate parameter	• Measure temperature and humidity inside and	Guide students to: • Measure	Thermometer, hygrometer,

important in CE structures. 7.2 Describe methods of temperature management in CE structures. 7.3 Describe humidity management. 7.4 Describe light management. 7.5 Describe the monitoring and recording of climate parameters inside a CEH structure. 7.6 Describe automated climate control systems. 7.7 Describe evaporative cooling systems. 7.8 Describe heating systems for greenhouses in cool highland areas of Nigeria. 7.9 Describe supplemental lighting systems. 7.10 Describe the energy requirements of supplemental	important in CE structures: - Temperature, - Humidity, - CO₂ - Light intensity • Explain methods of temperature management in CE structures: - Ventilation, - Evaporative cooling - Shade • Discuss humidity management: - Ventilation, - Spacing - Avoidance of overhead irrigation. • Discuss light management: - Supplemental lighting, - Shade netting - Reflective mulch. • Explain the monitoring and recording of climate parameters	guide, projector, white board, computer, internet.	outside the college CEH structure at 08:00 and 14:00 daily for 5 days • Calculate the temperature differential between inside and outside in relation to vent management • Adjust ventilation to lower inside temperature • Measure light intensity at three points inside the structure • Record readings • Compare readings with crop requirements • Monitor temperature, humidity and CO₂ inside the college CEA at 3-hour intervals for 3 days. • Operate the ventilation or evaporative cooling system. • Observe inside temperature before and 30 minutes after operation. • Measure light intensity at five points inside the structure	temperature and humidity inside and outside the college CEH structure at 08:00 and 14:00 daily for 5 days • Calculate the temperature differential between inside and outside in relation to vent management • Adjust ventilation to lower inside temperature • Measure light intensity at three points inside the structure • Record readings • Compare readings with crop requirements • Monitor temperature, humidity and CO₂ inside the college CEA at 3-hour intervals for 3 days. • Operate the	lux meter, ventilation controls, climate monitoring record form, Thermometer, hygrometer, CO₂ meter, lux meter, climate monitoring form, schedule template.
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	lighting systems. 7.11 Describe integrated climate management strategies for year-round	inside a CEH structure. • Discuss automated climate control systems: - Thermostats, - Humidity sensors - CO₂ controllers. • Discuss evaporative cooling systems: - Pad-and-fan - Fogging systems. • Explain heating systems for greenhouses in cool highland areas of Nigeria. • Discuss supplemental lighting systems: - LED grow lights • Discuss the energy requirements of supplemental lighting systems. • Explain integrated climate management		• Record readings • Identify low-light zones.	ventilation or evaporative cooling system. • Observe inside temperature before and 30 minutes after operation. • Measure light intensity at five points inside the structure • Record readings • Identify low-light zones.	
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		strategies for year-round				
General Objective 8.0: Understand nutrient management in controlled environment production						
14	8.1 Describe the nutrient requirements of CE vegetable crops by growth stage. 8.2 Describe nutrient solution preparation and their concentrations. 8.3 Describe EC and pH management in nutrient solutions 8.4 Describe their effect on nutrient uptake. 8.5 Explain fertigation scheduling in CEH. 8.6 Describe nutrient deficiency identification and correction in CEH crops. 8.7 Describe nutrient solution management.	• Discuss the nutrient requirements of CE vegetable crops by growth stage. • Explain nutrient solution preparation and their concentrations: - Macro an - Micro elements • Explain EC and pH management in nutrient solutions • Explain their effect on nutrient uptake. • Explain fertigation scheduling in CEH: - Frequency, - Duration - Volume per plant. • Discuss nutrient deficiency identification and correction in CEH crops.	Nutrient solution recipe, fertigation schedule, deficiency charts, projector.	• Prepare a nutrient solution at the correct EC and pH for CE at the vegetative stage • Measure EC and pH of three nutrient solutions • Compare with recommended levels with adjustment where needed. • Apply fertigation to a CEH crop; • Record rate, frequency and EC at delivery and pH at delivery. • Identify a nutrient deficiency symptom in a CEH crop and corrective action • Prepare a two-week fertigation schedule for CEH crop specifying EC, pH, frequency and volume per plant	Guide students to: • Prepare a nutrient solution at the correct EC and pH for CE at the vegetative stage • Measure EC and pH of three nutrient solutions • Compare with recommended levels with adjustment where needed. • Apply fertigation to a CEH crop; • Record rate, frequency and EC at delivery and pH at delivery. • Identify a nutrient deficiency symptom in a CEH crop and corrective action • Prepare a two-week fertigation schedule	Nutrient solution chemicals, EC meter, pH meter, fertigation system, deficiency photographs, schedule template.

		• Discuss nutrient solution management: - Stock solution preparation, - EC, - pH - Replenishment			for CEH crop specifying EC, pH, frequency and volume per plant	
General Objective 9.0: Understand the economics and enterprise management of CEH						
15	9.1 Describe the capital investment required for different CEH structure types in Nigeria. 9.2 Describe the operating costs of a CEH enterprise. 9.3 Explain the calculation of cost of production per kilogram in a CEH enterprise. 9.4 Explain the calculation of gross margin and return on investment for a CEH enterprise. 9.5 Describe marketing channels and target customers for CEH-	• Explain the capital investment required for different CEH structure types in Nigeria. • Explain the operating costs of a CEH enterprise: - Water, - Electricity, - Nutrients - Labour. • Describe the calculation of cost of production per kilogram in a CEH enterprise. • Describe the calculation of gross margin and return on investment for a	CEH investment cost template, operating cost record form, gross margin calculation worksheet, marketing research guide, business proposal template, field notebooks. CEH record forms, cost calculation	• Prepare an investment cost estimate for a 50 m² shade net house listing all materials and labour costs • Prepare a one-month operating cost record for the college CEH structure • Record all inputs and costs. • Calculate cost of production per kilogram for one CEH crop cycle • Record all cost items and final figure • Calculate gross margin and return on investment (ROI) for the college CEH enterprise for one	Guide students to: • Prepare an investment cost estimate for a 50 m² shade net house listing all materials and labour costs • Prepare a one-month operating cost record for the college CEH structure • Record all inputs and costs. • Calculate cost of production per kilogram for one CEH crop cycle • Record all cost items and final	CEH investment cost template, operating cost record form, gross margin calculation worksheet, marketing research guide, business proposal template, field notebooks. CEH record forms, cost calculation worksheet, scale-up plan template

	produced vegetables in Nigeria. 9.6 Describe record keeping systems for CEH enterprises: climate logs, production records and sales records. 9.7 Describe the challenges of CEH adoption by smallholders in Nigeria and 9.8 Explain how to overcome the challenges.	CEH enterprise. • Explain marketing channels and target customers for CEH-produced vegetables in Nigeria. • Explain record keeping systems for CEH enterprises: climate logs, production records and sales records. • Discuss the challenges of CEH adoption by smallholders in Nigeria and • Discuss how to overcome the challenges.	worksheet, scale-up plan template	crop cycle • Record all calculations • Complete one month of CEH production records for the college structure: - Climate, - Inputs - Yields • Identify marketing channels for CEH produce in the local area • Record channel, buyer type and price premium • Prepare a one-page CEH business proposal for a 100 m² structure including investment, costs, revenue and ROI	figure • Calculate gross margin and return on investment (ROI) for the college CEH enterprise for one crop cycle • Record all calculations • Complete one month of CEH production records for the college structure: - Climate, - Inputs - Yields • Identify marketing channels for CEH produce in the local area • Record channel, buyer type and price premium • Prepare a one-page CEH business proposal for a 100 m² structure including investment, costs,	
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					revenue and ROI	
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



FIELD PRACTICAL I (HORTICULTURAL PRODUCTION SYSTEMS)

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: FIELD PRACTICAL I (HORTICULTURAL PRODUCTION SYSTEMS)	COURSE CODE: HOT 125	CONTACT HOURS: 2 HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: NIL
YEAR: I SEMESTER: II	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide students with integrated practical experience in horticultural production systems through supervised farm-based activities.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Apply land preparation and crop establishment practices; 2.0 Apply crop management and cultural practices; 3.0 Carry out pest and disease management on the college farm; 4.0 Carry out harvesting and post-harvest operations; 5.0 Apply farm record keeping and enterprise accounting; 6.0 Demonstrate professional conduct and teamwork on the college farm.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: FIELD PRACTICAL I (HORTICULTURAL PRODUCTION SYSTEMS)			COURSE CODE: HOT 125		CONTACT HOURS: 2 HOURS/WEEK	
			CREDIT UNIT: 2		THEORETICAL: NIL	
YEAR: I SEMESTER: II			PREREQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with integrated practical experience in horticultural production systems through supervised farm-based activities.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Apply land preparation and crop establishment practices						
1 – 2				- Carry out land preparation: - Clearing, - Tillage, - Construction of seedbed, ridges, etc. - Establish horticultural crops on the prepared land at correct spacing - Carry out maintenance of tools and equipment - Prepare a farm establishment plan for the college farm activities - Measure and record the area	Guide students to: - Carry out land preparation: - Clearing, - Tillage, - Construction of seedbed, ridges, etc. - Establish horticultural crops on the prepared land at correct spacing - Carry out maintenance of tools and equipment - Prepare a farm establishment plan for the college farm	Farm tools, hoes, spades, compost, fertiliser, crop seeds or seedlings, measuring tape, establishment plan template.

8-9				• Carry out weekly scouting of all college farm crops over a period of time • Record pest or disease, percentage crop affected • Apply botanical pesticide • Record observations • Apply chemical pesticide correctly with full PPE using correct dosage • Compare pest population before and after management intervention • Calculate percentage reduction • Complete a pest and disease management record for all actions taken	Guide students to: • Carry out weekly scouting of all college farm crops over a period of time • Record pest or disease, percentage crop affected • Apply botanical pesticide • Record observations • Apply chemical pesticide correctly with full PPE using correct dosage • Compare pest population before and after management intervention • Calculate percentage reduction • Complete a pest and disease management record for all actions taken	Scouting form, Neem leaves, extraction equipment, PPE set, chemical pesticide, pesticide application record, management record form, field notebooks.
General Objective 4.0: Carryout harvesting and post-harvest operations						
10-11				• Harvest all crops on the college farm at correct maturity • Sort and grade all harvested produce • Package and label graded produce • Record packaging material,	Guide students to: • Harvest all crops on the college farm at correct maturity • Sort and grade all harvested produce • Package and label graded produce	Harvesting tools, grading containers, packaging materials, label template, weighing scale, yield calculation worksheet,

				net weight and total value at current market prices • Calculate yield per square metre for each crop • Record all steps.	• Record packaging material, net weight and total value at current market prices • Calculate yield per square metre for each crop • Record all steps.	harvest summary report template, field notebooks.
General Objective 5.0: Apply farm record keeping and enterprise accounting						
12-13				• Complete all farm records for everyday crops: - Input, - Production, - Harvest records, etc. • Prepare a farm income statement • Record all income and expenses by category • Calculate gross margin and net profit for the farm enterprise • Record all steps • Prepare a farm report summarising all crops, yields, pest problems and management outcomes • Present the farm report to the class explaining results, challenges and recommendations for	Guide students to: • Complete all farm records for everyday crops: - Input, - Production, - Harvest records, etc. • Prepare a farm income statement • Record all income and expenses by category • Calculate gross margin and net profit for the farm enterprise • Record all steps • Prepare a farm report summarising all crops, yields, pest problems and management outcomes • Present the farm report to the class explaining results, challenges and	All farm record forms, income statement template, gross margin worksheet, farm report template, field notebooks.

				improvement	recommendations for improvement	
General Objective 6.0: Demonstrate professional conduct and teamwork on the college farm						
14 – 15				• Report to the farm on time and in correct attire for every session • Record attendance and punctuality each week • Work as part of a farm team • Record your role, activities and a lesson learnt each week • Adhere to all health and safety rules on the farm • Record any hazard identified and the safety action taken • Prepare a Gantt chart for assigned farm activities for the semester • Prepare constructive feedback to one teammate at the end of the semester • Record two strengths and two areas for improvement	Guide students to: • Report to the farm on time and in correct attire for every session • Record attendance and punctuality each week • Work as part of a farm team • Record your role, activities and a lesson learnt each week • Adhere to all health and safety rules on the farm • Record any hazard identified and the safety action taken • Prepare a Gantt chart for assigned farm activities for the semester • Prepare constructive feedback to one teammate at the end of the semester • Record two strengths and two areas for improvement	Attendance register, team contribution record form, hazard record form, Gantt chart template, peer feedback form, field notebooks.
COURSE ASSESSMENT:						
Course work: 10%						
Test/Assignments: 10%						
Practical: 40%						

Examination:	40%
Total:	100%



CLIMATE-SMART AND PRECISION HORTICULTURAL PRODUCTION

PROGRAMME: NATIONAL DIPLOMA IN AGRICULTURAL TECHNOLOGY		
COURSE TITLE: CLIMATE-SMART AND PRECISION HORTICULTURAL PRODUCTION	COURSE CODE: HOT 126	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 2 HOURS/WEEK
YEAR: I SEMESTER: II	PREREQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in horticultural production using climate-smart and precision techniques.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles of climate-smart agricultural practices; 2.0 Know basic digital tools in horticultural crop production; 3.0 Understand the application of digital tools in land and soil management; 4.0 Understand GIS, remote sensing and spatial technologies in agriculture; 5.0 Know climate-smart agricultural practices and technologies; 6.0 Comprehend sustainability assessment and climate-informed decision-making; 7.0 Understand concepts of climate-smart agriculture and crop protection.		

PROGRAMME: NATIONAL DIPLOMA IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: CLIMATE-SMART AND PRECISION HORTICULTURAL PRODUCTION				COURSE CODE: HOT 126		CONTACT HOURS: 4HOURS/WEEK
				CREDIT UNIT: 4		THEORETICAL: 2 HOURS/WEEK
YEAR: I SEMESTER: II				PREREQUISITE:		PRACTICAL: 2 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in horticultural crop production using climate-smart and precision agriculture techniques.						
General Objective 1.0: Understand the principles of climate-smart agricultural practices						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1- 2	1.1 Explain climate change. 1.2 Explain the effects/impacts of climate change on horticultural crop production 1.3 Explain climate adaptation and mitigation strategies in agriculture 1.4 Explain the concept of climate-resilient crops and sustainable practices	• Discuss climate change using local examples - Drought, - Flooding, - Irregular rainfall • Discuss adaptation strategies such as mulching, irrigation, and crop selection • Explain using charts and case studies to illustrate climate-resilient crops and sustainable practices • Discuss local climate challenges and solutions	Textbooks, Journals, Internet, Articles, Projector, Diagrams/charts, Marker board, Marker, Case, studies, videos	• Analyse climate charts and case studies to sustainable practices • Apply mulching, shading and moisture conservation techniques on field plots • Practice water management techniques - Basins, - Ridges, - Drip, - Sprinkler irrigation • Establish trial plots using improved or climate-resilient crop varieties	Guide students to: • Analyse climate charts and case studies to sustainable practices • Apply mulching, shading and moisture conservation techniques on field plots • Practice water management techniques - Basins, - Ridges, - Drip, - Sprinkler irrigation • Establish trial plots	Organic materials (mulch), farm tools, improved seeds, watering cans, farm plots, Practical manual.

					using improved or climate-resilient crop varieties	
General Objective 2.0: Know basic digital tools in horticultural crop production						
3 – 4	2.1 Explain ICT tools used in agriculture. 2.2 Explain basic principles of GPS and farm mapping. 2.3 Explain farm data collection, storage and use in decision making. 2.4 Explain the importance of data in farm management and decision making	- Describe ICT tools used in agriculture - Mobile apps, - Sensors, - GPS, - Drones, - DSSAT, etc. - Discuss basic principles of GPS and farm mapping. - Describe farm data collection, storage and use in decision making. - Discuss the importance of data in farm management and decision making	Textbooks, Journals, Internet, Articles, Projector, Diagrams/charts, Marker board, Marker, Smartphones, videos, Simple farm apps, GPS devices, computer, internet.	- Use mobile phones/apps to record farm data (- Planting date, - Inputs, - Yields - Carry out simple farm mapping using GPS or mobile-based tools - Collect farm data manually - Interpret the data for decision making. - Collect farm data digitally. - Interpret the data for decision making.	Guide students to: - Use mobile phones/apps to record farm data (- Planting date, - Inputs, - Yields - Carry out simple farm mapping using GPS or mobile-based tools - Collect farm data manually - Interpret the data for decision making. - Collect farm data digitally. - Interpret the data for decision making.	Smartphones, mobile apps, GPS devices, record books, sample data sheets Practical manual
General Objective 3.0: Understand the application of digital tools in land and soil management						
5 – 7	3.1 Explain the role of digital technologies in soil and land management. 3.2 Explain the basic tools	Discuss the role of digital technologies in soil and land management	Textbooks, Journals, Internet, Articles, Projector,	- Use mobile apps to access soil and weather information - Demonstrate basic use of GPS and drones (where	Guide students to: - Use mobile apps to access soil and weather information - Demonstrate basic	GPS, GIS software, drones, mobile apps, videos,

	used in digital agriculture. 3.3 Explain the use of digital tools in soil sampling, fertiliser application and land planning. 3.4 Describe use of mobile applications for soil information, weather data and advisory services. 3.5 Explain the benefits and limitations of digital tools in agriculture	- Data collection, - Mapping, - Monitoring, etc. • Describe the basic tools used in digital agriculture: - GPS, - Drones, - Mobile apps, - Sensors, - Simple GIS concepts, etc. • Discuss the use of digital tools in soil sampling, fertiliser application and land planning. • Explain use of mobile applications for soil information, weather data and advisory services. • Discuss the benefits and limitations of digital tools in agriculture	Diagrams/charts, Marker board, Marker, Charts.	available) in location tracking on farm • Record simple land or soil data using mobile devices • Interpret digital information for basic farm decisions • Use simple digital advisory tools for soil information, weather data, E-weather channel, mobile apps, etc.	use of GPS and drones (where available) in location tracking on farm • Record simple land or soil data using mobile devices • Interpret digital information for basic farm decisions • Use simple digital advisory tools for soil information, weather data, E-weather channel, mobile apps, etc.	documentaries, stimulation software,
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General Objective 4.0: Understand GIS, remote sensing and spatial technologies in agriculture						
8 – 9	4.1 Define Geographic Information System (GIS) 4.2 Explain its four components. 4.3 Explain the role of GIS in agriculture. 4.4 Explain the Global Positioning System (GPS). 4.5 Explain spatial data types. 4.6 Describe the basics of remote sensing. 4.7 Explain applications of GIS and remote sensing in precision agriculture. 4.8 Describe map reading and interpretation techniques. 4.9 Explain the integration of GIS with other digital farm tools (farm management systems, sensors, weather data). 4.10 Explain the role of spatial data in precision agriculture.	- Define Geographic Information System (GIS) - Discuss its four components: - Hardware, - Software, - Data - People. - Discuss the role of GIS in agriculture: - Farm mapping, - Land-use planning, - Soil and crop analysis, - Yield zone delineation. - Explain the Global Positioning System (GPS): - Principles, - Accuracy, - Coordinate systems	Computers, sample maps, agricultural zone shapefiles, Landsat/Sentinel imagery, agricultural maps, projector. Case-study handouts, drone overview video.	- Collect GPS coordinates of 5 points on the campus using smartphones - Record latitude/longitude. - Open a sample shapefile in QGIS - Identify vector features (points/lines/polygons) and label them. - Identify a raster image (satellite imagery) in QGIS. - Download a free Sentinel-2 image tile covering a Nigerian agricultural area (via Copernicus Open Access Hub or Earth Explorer) - Load the image in QGIS. - Compute NDVI for the image - Classify into vegetation density zones. - Read an agricultural	Guide students to: - Collect GPS coordinates of 5 points on the campus using smartphones - Record latitude/longitude - Open a sample shapefile in QGIS - Identify vector features (points/lines/polygons) and label them. - Identify a raster image (satellite imagery) in QGIS. - Download a free Sentinel-2 image tile covering a Nigerian agricultural area (via Copernicus Open Access Hub or Earth Explorer) - Load the image in QGIS.	GPS, smart phone, GIS software, QGIS (free), computers, internet, videos, documentaries,

	4.11 Describe benefits and limitations of GIS and spatial technologies for smallholder farmers in Nigeria. 4.12 Explain drone applications in agriculture in Nigeria.	(latitude/longitude, UTM) - Agricultural applications. • Discuss spatial data types: - Vector (points, lines, polygons) - Raster (pixel grids, satellite images) data. • Discuss remote sensing basics: - Electromagnetic spectrum, - Sensor types, - Satellite platforms (Landsat, Sentinel, Planet) - Drone imagery concepts. • Discuss applications of GIS and remote sensing in precision		map. • Identify scale, legend, crop zones and water bodies. • Digitise a simple farm layout from a sketch map • Create polygon features for field boundaries and label with crop names in QGIS. • Overlay two layers (soil type + crop field) • Identify management zones. • Prepare a simple farm map with title, north arrow, scale and legend for printing.	• Compute NDVI for the image • Classify into vegetation density zones. • Read an agricultural map. • Identify scale, legend, crop zones and water bodies. • Digitise a simple farm layout from a sketch map • Create polygon features for field boundaries and label with crop names in QGIS. • Overlay two layers (soil type + crop field) • Identify management zones. • Prepare a simple farm map with title, north arrow, scale and legend for printing.	
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		agriculture: - NDVI mapping, - Soil mapping, - Flood/Drought monitoring, - Yield zone mapping. • Explain map reading and interpretation techniques: - Scale, - Legend, - Symbols - Coordinate grids. • Discuss the integration of GIS with other digital farm tools (farm management systems, sensors, weather data). • Explain the role of spatial data in precision				
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		agriculture: - Variable-rate application, - Management zones - Site-specific crop management. • Discuss benefits and limitations of GIS and spatial technologies for smallholder farmers in Nigeria. • Discuss drone applications in agriculture in Nigeria: - Crop scouting, - Area measurement, - Spraying overview - Legal framework				
General Objective 5.0: Know climate-smart agricultural practices and technologies						
10 – 11	5.1 Explain climate-smart agriculture (CSA) principles	• Discuss climate-smart agriculture (CSA) principles	Textbooks, Journals, Internet,	• Implement conservation agriculture practices • Apply mulching and	Guide students to: • Implement conservation	Farm tools, irrigation kits, climate

5.2 Describe CSA practices. 5.3 Explain drought-tolerant and resilient crop varieties 5.4 Describe water management techniques. 5.5 Explain soil moisture conservation practices 5.6 Describe integration of crops, livestock and trees 5.7 Explain the role of technology in CSA and Climate Smart dimensions 5.8 Describe benefits and limitations of CSA practices 5.9 Explain scaling CSA practices	• Explain CSA practices - Conservation agriculture, - Agroforestry, - Irrigation efficiency etc. • Explain drought-tolerant and resilient crop varieties • Explain water management techniques - Rainwater harvesting, - Drip irrigation etc. • Discuss soil moisture conservation practices • Explain integration of crops, livestock and trees • Discuss the role of technology in CSA and Climate Smart dimensions • Discuss the benefits and	Articles, Projector, Computer, Diagrams/charts, Marker board, Marker, Pictures, Videos, charts Field plots, tools, climate smart tools, meteorological data.	water conservation techniques • Establish simple agroforestry systems • Demonstrate efficient irrigation methods • Illustrate Climate Smart dimensions • Evaluate effectiveness of CSA practices • Record results and observations	agriculture practices • Apply mulching and water conservation techniques • Establish simple agroforestry systems • Demonstrate efficient irrigation methods • Illustrate Climate Smart dimensions • Evaluate effectiveness of CSA practices • Record results and observations	smart apps, meteorological data, practical manual
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		limitations of CSA practices • Discuss scaling CSA practices				
General Objective 6.0: Comprehend sustainability assessment and climate-informed decision-making						
12 – 13	6.1 Explain sustainability indicators in agriculture 6.2 Describe environmental, economic and social sustainability 6.3 Explain sustainability assessment tools 6.4 Describe climate-informed decision-making processes 6.5 Explain data-driven sustainability planning 6.6 Describe monitoring and evaluation of sustainability 6.7 Explain reporting and documentation 6.8 Describe challenges in sustainability implementation 6.9 Explain continuous improvement strategies	• Discuss sustainability indicators in agriculture • Discuss environmental, economic and social sustainability • Describe sustainability assessment tools • Explain climate-informed decision-making processes • Describe data-driven sustainability planning • Explain monitoring and evaluation of sustainability • Discuss reporting and	Textbooks, Journals, Internet, Articles, Projector, Computer, Diagrams/charts, Marker board, Marker, Pictures, Videos Crop samples, charts Templates, data.	• Assess sustainability of farm systems within the community • Develop sustainability improvement plans for the community • Analyze environmental and economic data • Prepare sustainability reports • Present climate-informed decisions • Evaluate outcomes	Guide students to: • Assess sustainability of farm systems within the community • Develop sustainability improvement plans for the community • Analyze environmental and economic data • Prepare sustainability reports • Present climate-informed decisions • Evaluate outcomes	Field tools, meteorological station templates, datasets, practical manual

		documentation • Discuss challenges in sustainability implementation • Describe continuous improvement strategies				
General Objective 7.0: Understand concepts of climate-smart agriculture and crop protection						
14 – 15	7.1 Explain the concepts of climate-smart agriculture and crop protection 7.2 Explain pest monitoring techniques 7.3 Describe disease monitoring and assessment 7.4 Explain forecasting concepts and prediction models 7.5 Describe climate change impacts on pest and disease dynamics 7.6 Describe the use of digital technologies in pest management	• Discuss the concepts of climate-smart agriculture and crop protection • Describe pest monitoring techniques • Explain disease monitoring and assessment • Explain forecasting concepts and prediction models • Discuss climate change impacts on pest and disease dynamics • Explain the use of digital technologies in	Projector, climate data charts, textbooks, multimedia materials, journals, videos, laptops, internet Weather records, forecasting software, Climate databases, case studies, reports	• Demonstrate climate data interpretation and its effect on pest occurrence • Demonstrate installation and use of traps and monitoring devices • Measure disease incidence and severity using standard procedures • Demonstrate use of weather data and forecasting charts • Analyze historical pest and weather records with students • Demonstrate use of mobile applications and digital monitoring systems	Guide students to: • Demonstrate climate data interpretation and its effect on pest occurrence • Demonstrate installation and use of traps and monitoring devices • Measure disease incidence and severity using standard procedures • Demonstrate use of weather data and forecasting charts • Analyze historical pest and weather records	Projector, climate data charts, multimedia materials, journals, videos, laptops, internet Sticky traps, pheromone traps, sweep nets, field guides Disease assessment sheets, field plots, disease scales Weather records, forecasting

		decision-making processes	

ORNAMENTAL HORTICULTURE AND LANDSCAPING

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY			
	COURSE TITLE: ORNAMENTAL HORTICULTURE AND LANDSCAPING	COURSE CODE: HOT 127	CONTACT HOURS: 3 HOURS/WEEK
		CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
	YEAR: I SEMESTER: II	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills in ornamental plant production, garden design and basic landscaping operations.			
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the scope and importance of ornamental horticulture and landscaping; 2.0 Know the classification and identification of common ornamental plants; 3.0 Know propagation practices for ornamental plants; 4.0 Know garden design and layout principles; 5.0 Understand the establishment and maintenance of lawns and flower beds; 6.0 Know hedge, topiary and ornamental feature establishment and maintenance.			

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: ORNAMENTAL HORTICULTURE AND LANDSCAPING			COURSE CODE: HOT 127		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PREREQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills in ornamental plant production, garden design and basic landscaping operations.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Know the scope and importance of ornamental horticulture and landscaping						
1 – 2	1.1 Explain ornamental horticulture and landscaping. 1.2 Describe the environmental, economic and social importance of ornamental horticulture. 1.3 State career and enterprise opportunities for ND graduates in the	- Discuss ornamental horticulture and landscaping. - Differentiate between ornamental horticulture, landscaping, and food crop production. - Explain the environmental, economic and social importance of ornamental horticulture in Nigeria	Ornamental horticulture scope diagram, career opportunity chart, environmental role photographs, industry growth data, projector, white marker board, internet, computer.	- Visit a landscaping company or ornamental nursery; - Record plants observed - Identify ornamental businesses in the local area - Identify environmental, economic and social benefits of ornamental plants on the college campus - Prepare a career pathway chart showing five career options in the ornamental sector	Guide students to: - Visit a landscaping company or ornamental nursery; - Record plants observed - Identify ornamental businesses in the local area - Identify environmental, economic and social benefits of	Observation form, report template, research template, career pathway template.

	ornamental sector. 1.4 Describe the growth of the ornamental horticulture industry in Nigeria.	- List career opportunities with job titles and typical income in ornamental horticulture. - Discuss industry scope and growth drivers in Nigeria			ornamental plants on the college campus Prepare a career pathway chart showing five career options in the ornamental sector	
General Objective 2.0: Understand classification and identification of common ornamental plants						
3 – 4	2.1 Explain the classification of ornamental plants by life cycle with examples. 2.2 Explain the classification of ornamental plants by growth habit. 2.3 Explain the classification of ornamental plants by use. 2.4 List common ornamental plants by local name, botanical name and ornamental	- Discuss the classification of ornamental plants by life cycle with examples: - Annuals, - Biennials, - Perennials. - Discuss the classification of ornamental plants by growth habit: - Trees, - Shrubs, - Climbers, - Ground covers - Succulents - Explain the classification of ornamental plants	Classification chart, ornamental plant photographs, botanical name list, care requirement table, projector, computer, mobile identification apps, textbooks, journals, internet.	- Collect photograph of ornamentals within the campus - Classify each by life cycle, habit and use. - Prepare an identification album for ornamental plants - Give local name, botanical name and ornamental value for each. - Prepare management cards for ornamentals. - Design a display board of ornamentals with local name, botanical name and management tip per plant	Guide students to: - Collect photograph of ornamentals within the campus - Classify each by life cycle, habit and use. - Prepare an identification album for ornamental plants - Give local name, botanical name and ornamental value for each. - Prepare management cards for ornamentals. - Design a display board of	Campus plants, classification table template, album template, botanical name list, unlabeled specimens, Answer key, care card template, display board materials, field notebooks

	value. 2.5 Describe management requirements for ornamentals.	by use: - Foliage, - Flowering, - Hedge, - Lawn, - Indoor plants etc. • Explain common ornamental plants by local name, botanical name and ornamental value. • Explain management requirements for ornamentals: - Light, - Watering, - Fertiliser - Pruning needs			ornamentals with local name, botanical name and management tip per plant	
General Objective 3.0: Know propagation practices for ornamental plants						
5 – 7	3.1 Describe seed propagation of ornamentals. 3.2 Describe stem cutting types for ornamentals. 3.3 State suitable	• Explain seed propagation of ornamentals: - Collection, - Pre-treatment, - Sowing - Transplanting. • Explain stem cutting types	Classification chart, ornamental plant photographs, botanical name list, care requirement table, projector, computer, mobile identification	• Prepare cuttings of ornamental species • Record type, medium and hormone • Check rooting periodically. • Sow seeds of annual ornamentals in trays • Calculate germination percentage • Carry out division on clump-	Guide students to: • Prepare cuttings of ornamental species • Record type, medium and hormone • Check rooting periodically. • Sow seeds of	Cutting material, seed trays, ornamental seeds, rooting medium, rooting hormone, clump-forming

	species for each of the cutting types.	for ornamentals: - Softwood, - Semi-hardwood	apps, textbooks, journals, internet.	forming ornamentals • Re-pot each division • Record condition periodically • Remove offsets from an agave or aloe • Pot and record species, number and condition periodically. • Carry out budding on ornamental rootstocks • Record date and union condition at intervals	annual ornamentals in trays • Calculate germination percentage • Carry out division on clump-forming ornamentals • Re-pot each division • Record condition periodically • Remove offsets from an agave or aloe • Pot and record species, number and condition periodically. • Carry out budding on ornamental rootstocks • Record date and union condition at intervals	ornamentals, agave or aloe, ornamental rootstocks, budding tape, pots.
3.4	Describe division and offset removal for clump-forming and succulent ornamentals.	• Explain suitable species for each of the cutting types. • Explain division and offset removal for clump-forming and succulent ornamentals.				
3.5	Describe budding and grafting for ornamentals.	• Explain budding and grafting for ornamentals.				
3.6	Explain factors affecting rooting.	• Discuss factors affecting rooting: - Humidity, - Temperature, - Rooting - Hormone - Light management				

General Objective 4.0: Know garden design and layout principles

8 – 9	4.1 Explain garden design principles. 4.2 Describe formal, informal, cottage, tropical and Japanese garden styles. 4.3 Describe hardscape and softscape elements. 4.4 Describe components of a complete garden design.	• Discuss garden design principles: - Balance, - Proportion, - Rhythm, - Unity, - Contrast - Simplicity. • Explain formal, informal, cottage, tropical and Japanese garden styles. • Explain hardscape and softscape elements. • Explain components of a complete garden design: - Base plan, - Plant schedule - Cost estimate.	Garden design photographs/charts, garden style photographs and charts, labelled design drawing, graph paper, rulers, plant schedule template, cost estimate template, projector, white marker board.	• Survey a 10m x 10m campus area; record features and shade patterns. • Draw an existing site plan at 1:50 scale. • Prepare a concept sketch for the surveyed area; annotate proposed hardscape and softscape elements. • Produce a finished scaled design on graph paper; include legend, north arrow and scale bar • Prepare a plant schedule listing species, quantity and landscape function for the design • Present the design to the class; explain concept, species selected and total estimated cost.	Guide students to: • Survey a 10m x 10m campus area; record features and shade patterns. • Draw an existing site plan at 1:50 scale. • Prepare a concept sketch for the surveyed area; annotate proposed hardscape and softscape elements. • Produce a finished scaled design on graph paper; include legend, north arrow and scale bar • Prepare a plant schedule listing species, quantity and landscape function for the design Present the design to the class; explain concept, species selected and total estimated cost.	Measuring tapes, graph paper, rulers, pencils, design symbols guide, plant schedule template, cost estimate template.
General Objective 5.0: Understand the establishment and maintenance of lawns and flower beds						
10 –	5.1 List common	• Describe common	Lawn grass	• Establish a lawn area by	Guide students to:	Lawn grass

12	lawn grass species in Nigeria 5.2 Describe the characteristics and suitability of each. 5.3 Explain lawn establishment methods. 5.4 Explain lawn maintenance. 5.5 Describe flower bed establishment. 5.6 Describe flower bed maintenance.	lawn grass species in Nigeria • Explain the characteristics and suitability of each. • Describe lawn establishment methods: - Turfing, - Sprigging, - Plugging - Seeding. • Discuss lawn maintenance: - Mowing height, - Edging, - Watering, - Fertilising - Weed control. • Explain flower bed establishment: - Soil preparation, - Planting arrangement - Edging. • Explain flower bed maintenance: - Deadheading, - Fertilising, - Watering - Pest management	specimens, lawn mower, edging tools, flower bed guide, , projector.	sprigging • Apply starter fertilizer and water • Record date and method. • Carry out lawn maintenance: solution - Mowing, - Edging - Fertilizer application • Record activities and observations before and after. • Establish a flower bed for annuals and perennials species separately • Carry out flower bed maintenance:including - Deadheading, - Fertilizer application - Watering • Identify lawn weeds present • Classify as broadleaf or grass. • Carry out hand weeding	• Establish a lawn area by sprigging • Apply starter fertilizer and water • Record date and method. • Carry out lawn maintenance: - Mowing, - Edging - Fertilizer application • Record activities and observations before and after. • Establish a flower bed for annuals and perennials species separately • Carry out flower bed maintenance: - Deadheading, - Fertilizer application - Watering • Identify lawn weeds present • Classify as broadleaf or grass. • Carry out hand	sprigs, starter fertilizer, lawn mower, edging shears, watering equipment, flowering plant seedlings, compost, weed reference guide.
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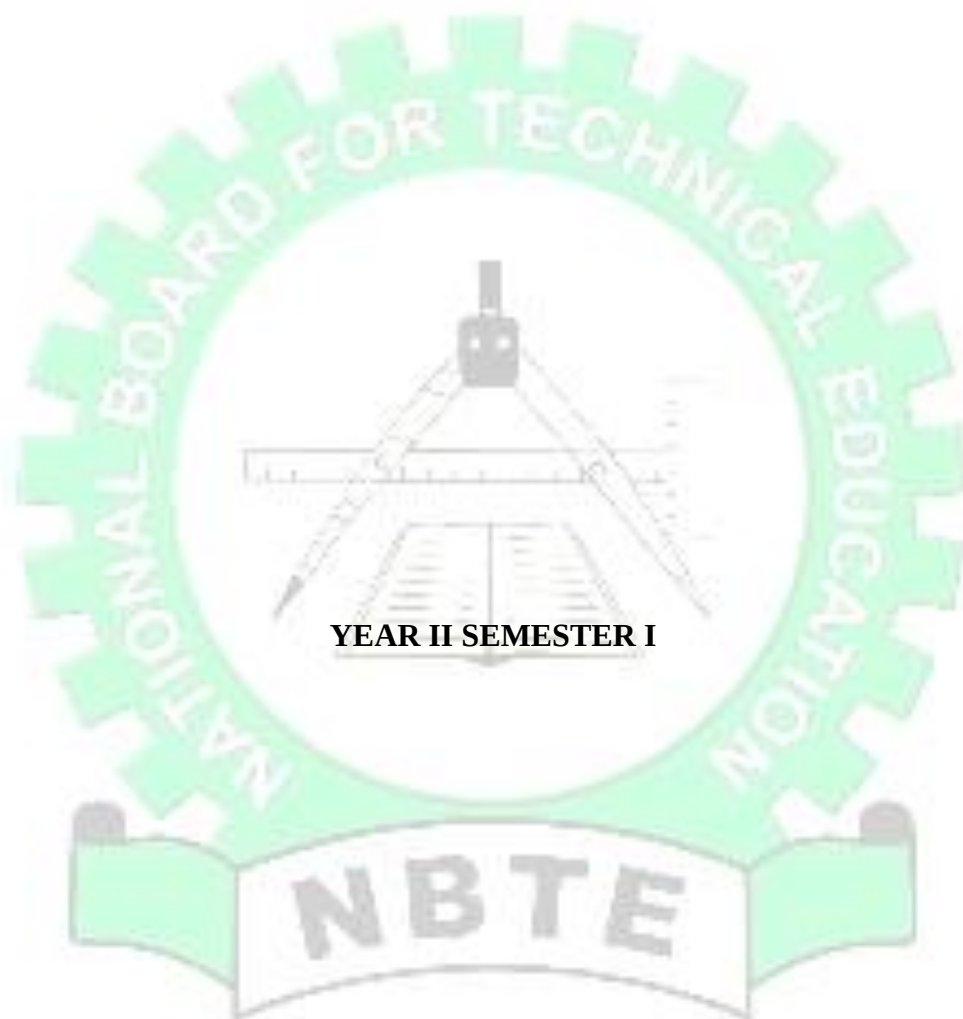
					weeding	
General Objective 6.0: Know hedge, topiary and ornamental feature establishment and maintenance						
13 – 15	6.1 Describe common hedge plant species in Nigeria. 6.2 Explain growth rate and suitability of each. 6.3 Describe hedge establishment. 6.4 Describe hedge maintenance. 6.5 Explain topiary. 6.6 Define suitable species, basic shapes and shaping techniques of a topiary. 6.7 Describe how to prepare a landscape maintenance contract.	• Explain common hedge plant species in Nigeria • Describe growth rate and suitability of each. • Explain hedge establishment: - Site preparation - Spacing, - Staking, - Fertilization - Mulching. • Explain hedge maintenance: - Trimming - Frequency, - Technique, - fertilization - Pest control. • Describe topiary. • Explain suitable species, basic shapes and shaping techniques of a topiary. • Explain how to prepare a landscape	Topiary photographs, topiary frame, sample contract, pricing guide, projector.	• Establish a hedge at correct spacing • Trim an established hedge to uniform height and width; • Record dimensions before and after trimming. • Shape one Duranta or Ixora shrub using a wire frame; • Record shape, frame size and time taken. • Establish a container garden with ornamental plants. • Prepare a maintenance contract for a garden specifying services frequency, monthly rate and payment terms	Guide students to: • Establish a hedge at correct spacing • Trim an established hedge to uniform height and width; • Record dimensions before and after trimming. • Shape one Duranta or Ixora shrub using a wire frame; • Record shape, frame size and time taken. • Establish a container garden with ornamental plants. • Prepare a maintenance contract for a garden specifying services frequency, monthly rate and payment terms	Hedge plant seedlings, measuring tape, guide strings, hedge shears, Duranta or Ixora shrub, wire mesh, ornamental containers, growing medium, plant seedlings, labels, contract template, field notebooks.

		maintenance contract: - Services, frequency, - Duration - Pricing				
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COURSE ASSESSMENT:

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





HORTICULTURAL CROP PHYSIOLOGY**PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY**

COURSE TITLE: HORTICULTURAL CROP PHYSIOLOGY	COURSE CODE: HOT 211	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 2 HOURS/WEEK
YEAR: II SEMESTER: I	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK

GOAL: This course is designed to equip students with knowledge and skills of the physiological processes that govern growth, development and quality in horticultural crops.

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

- 1.0 Know plant growth and development processes;
- 2.0 Understand photosynthesis and respiration in horticultural crops;
- 3.0 Understand water relations and transpiration in horticultural crops;
- 4.0 Understand plant hormones and their role in horticultural crops;
- 5.0 Understand flowering, fruiting and senescence physiology;
- 6.0 Apply physiological knowledge to improve horticultural crop production.

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: HORTICULTURAL CROP PHYSIOLOGY			COURSE CODE: HOT 211		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 2 HOUR/WEEK	
YEAR: II SEMESTER: I			PREREQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills of the physiological processes that govern growth, development and quality in horticultural crops.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Know plant growth and development processes						
1-2	1.1 Explain Plant physiology. 1.2 Describe the stages of plant growth. 1.3 Describe primary and secondary growth in horticultural plants. 1.4 Describe the role of meristems in	- Discuss Plant physiology: - Major life processes in plant physiology, - Scope in crop production, - Importance of plant physiology - Relationship with other related fields of agriculture. - Explain the stages of plant growth: - Germination, - Vegetative,	Growth curve diagram, primary and secondary growth charts, meristem diagram, source-sink diagram, temperature effect guide, computer, projector, white board makers, internet,	- Measure plant height of tagged plants periodically - Plot a growth curve for each. - Identify the apical meristem, lateral bud and intercalary meristem on plant species. - Identify source and sink relationship in a fruiting horticultural crop - Record which organs are sources	Guide students to: - Measure and record plant height of tagged plants periodically - Plot a growth curve for each. - Identify the apical meristem, lateral bud and intercalary meristem on plant species. - Identify source and sink	Tagged plants, ruler, temperature recording form, growth curve graph paper, source-sink diagram, growth stage record form.

	plant growth. 1.5 Explain source and sink in assimilate distribution in plants. 1.6 Describe how temperature affects growth rate and development in horticultural crops	- Reproductive - Senescence. • Explain primary and secondary growth in horticultural plants. • Discuss the role of meristems in plant growth: - Apical, - Lateral - Intercalary meristems. • Discuss source and sink in assimilate distribution in plants. • Discuss how temperature affects growth rate and development in horticultural crops	videos,	and sinks. • Record minimum and maximum daily temperature on the college farm weekly. • Calculate average growing degree days. • Prepare a growth stage record for horticultural crop from germination to harvest • Record the date each stage was reached	relationship in a fruiting horticultural crop • Record which organs are sources and sinks. • Record minimum and maximum daily temperature on the college farm weekly. • Calculate average growing degree days. • Prepare a growth stage record for horticultural crop from germination to harvest • Record the date each stage was reached	
General Objective 2.0: Understand photosynthesis and respiration in horticultural crops						
3 – 4	2.1 Describe the process of photosynthesis:	• Explain the process of photosynthesis: light and dark reactions and their	Photosynthesis chart, limiting factors graph, respiration	• Measure leaf chlorophyll content using a SPAD meter on tagged	Guide students to: • Measure leaf chlorophyll content using a	SPAD meter, aquatic plant, tomato samples, weighing scale,

	light and dark reactions and their products. 2.2 Explain the factors affecting photosynthetic rate in horticultural crops. 2.3 Describe the process of respiration. 2.4 Describe the importance of respiration in post-harvest physiology. 2.5 Explain the relationship between photosynthesis, dry matter accumulation and crop yield. 2.6 Describe light management in Controlled	products. • Discuss the factors affecting photosynthetic rate in horticultural crops. • Explain the process of respiration • Explain the importance of respiration in post-harvest physiology. • Discuss the relationship between photosynthesis, dry matter accumulation and crop yield. • Discuss light management in Controlled Environment (CE) as it affects photosynthesis and crop quality.	diagram, dry matter accumulation model, CE light management guide, projector, digital scale.	plants • Record the average. • Set up a simple experiment by placing aquatic plant in sunlight and counting bubbles per minute to observe photosynthesis. • Measure weight loss of harvested horticultural crops at room temperature over a period of time • Calculate daily respiration rate. • Compare leaf colour and crop growth between a shaded and unshaded plot • Record observations in relation to photosynthesis. • Prepare a table summarising factors that limit photosynthesis and	SPAD meter on tagged plants • Record the average. • Set up a simple experiment by placing aquatic plant in sunlight and counting bubbles per minute to observe photosynthesis. • Measure weight loss of harvested horticultural crops at room temperature over a period of time • Calculate daily respiration rate. • Compare leaf colour and crop growth between a shaded and unshaded plot • Record observations in relation to photosynthesis.	shaded and unshaded plots, factor summary table template.
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	Environment (CE) as it affects photosynthesis and crop quality.			their management in horticulture	• Prepare a table summarising factors that limit photosynthesis and their management in horticulture	
General Objective 3.0: Understand water relations and transpiration in horticultural crops						
5 – 6	3.1 Describe water uptake by roots. 3.2 Describe water movement through the plant. 3.3 Describe transpiration. 3.4 Explain the factors affecting the rate of transpiration. 3.5 Explain the relationship between water deficit and plant growth. 3.6 Describe	• Explain water uptake by roots: - Osmosis, - Root pressure - The role of root hairs. • Explain water movement through the plant: - Xylem transport - The cohesion-tension theory. • Explain transpiration: - Stomatal - Cuticular transpiration • Discuss the factors affecting the rate of transpiration. • Discuss the relationship between water deficit and	Osmosis diagram, cohesion-tension diagram, transpiration factor table, yield-water relationship curve, stress adaptation photographs, projector.	• Demonstrate osmosis using potato strips in salt and distilled water. • Observe wilting of a potted plant by withholding water • Record days to wilting and recovery after re-watering. • Measure transpiration rate of one leafy plant using a simple potometer • Record water uptake per hour. • Compare stomatal density on the upper and lower leaf surfaces of	Guide students to: • Demonstrate osmosis using potato strips in salt and distilled water. • Observe wilting of a potted plant by withholding water Record days to wilting and recovery after re-watering. • Measure transpiration rate of one leafy plant using a simple potometer • Record water uptake per hour.	Potato strips, salt solution, potted plants, simple potometer, microscope or hand lens, stress indicator table template.

	adaptations of horticultural crops to water stress.	plant growth: - Wilting - Yield loss. • Explain adaptations of horticultural crops to water stress: - Leaf rolling, - Stomatal closure - Root growth.		crops using a microscope or hand lens. • Prepare water stress indicator table for horticultural crops.	• Compare stomatal density on the upper and lower leaf surfaces of crops using a microscope or hand lens. • Prepare water stress indicator table for horticultural crops.	
General Objective 4.0: Understand plant hormones and their role in horticultural crops						
7 – 9	4.1 Explain the major plant hormones. 4.2 Explain auxin control in apical dominance 4.3 Explain the application of auxin control in pruning management. 4.4 Explain ethylene	• Discuss the major plant hormones: - Auxin, - Gibberellin, - Cytokinin, - Absciscic acid - Ethylene. • Describe auxin control in apical dominance • Describe the application of auxin control in pruning management. • Describe ethylene control in ripening	Plant hormone summary chart, apical dominance diagram, ethylene ripening diagram, growth regulator application guide, ABA role diagram, projector, white marker board.	• Demonstrate apical dominance by removing the apical bud of horticultural plants. • Count lateral shoots at interval comparing it with unpruned control. • Apply rooting hormone to cuttings at three concentrations; • Compare rooting percentage at	Guide students to: • Demonstrate apical dominance by removing the apical bud of horticultural plants. • Count lateral shoots at interval comparing it with unpruned control. • Apply rooting hormone to	Potted plants, rooting hormone at three concentrations, ripe apple, banana, hormone function summary table template.

control in ripening 4.5 Explain the management of ethylene control in post-harvest storage. 4.6 Describe the commercial use of growth regulators in horticulture. 4.7 Explain abscisic acid control in stomatal closure and dormancy in horticultural crops.	• Discuss the management of ethylene control in post-harvest storage. • Explain the commercial use of growth regulators in horticulture: - Rooting hormone, - Fruit set - Thinning. • Describe abscisic acid control in stomatal closure and dormancy in horticultural crops.		interval for each treatment. • Expose unripe banana to ethylene comparing ripening rate with a control. • Calculate the effect of auxin on fruit set by comparing sprayed and unsprayed flowers. • Prepare a hormone function summary table listing each hormone, site of production, primary role and one horticultural application	cuttings at three concentrations; • Compare rooting percentage at interval for each treatment. • Expose unripe banana to ethylene comparing ripening rate with a control. • Calculate the effect of auxin on fruit set by comparing sprayed and unsprayed flowers. • Prepare a hormone function summary table listing each hormone, site of production, primary role and one horticultural application	
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General Objective 5.0: Understand flowering, fruiting and senescence physiology

10 – 12	5.1 Describe photo periodism with horticultural plant examples. 5.2 Describe vernalisation and its role in flowering of biennial vegetables. 5.3 Describe fruit set, fruit development 5.4 Describe factors affecting fruit quality. 5.5 Describe the physiology of fruit ripening. 5.6 Describe leaf and fruit senescence. 5.7 Describe the management of leaf and fruit senescence in	• Explain photo periodism with horticultural plant examples: - Short-day, - Long-day - Day-neutral plants. • Discuss vernalisation and its role in flowering of biennial vegetables. • Explain fruit set, fruit development • Explain factors affecting fruit quality. • Explain the physiology of fruit ripening: - Colour change, - Softening - Aroma development. • Explain leaf and fruit senescence. • Discuss the management of leaf and fruit senescence in post-harvest handling.	Day-length response diagram, vernalisation guide, fruit development diagram, ripening physiology diagram, senescence management guide, projector.	• Classify horticultural crops as short-day, long-day or day-neutral • Observe the effect of temperature on onion bulbing or bolting on the college farm • Monitor fruit development on horticultural crop from fruit set to harvest Record size, colour and firmness at each visit • Observe ripening of mango or tomato Record colour, firmness and aroma at 2-day intervals until fully ripe. • Compare shelf life of produce stored with and without ethylene absorber • Record quality at 3 and 5 days	Guide students to: • Classify horticultural crops as short-day, long-day or day-neutral • Observe and record the effect of temperature on onion bulbing or bolting on the college farm • Monitor fruit development on horticultural crop from fruit set to harvest Record size, colour and firmness at each visit • Observe ripening of mango or tomato Record colour, firmness and	horticultural crop specimens, ripening fruit, ethylene absorber sachets, colour chart, firmness tester or press test guide.
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	post-harvest handling.				aroma at 2-day intervals until fully ripe. • Compare shelf life of produce stored with and without ethylene absorber • Record quality at 3 and 5 days	
General Objective 6.0: Apply physiological knowledge to improve horticultural crop production						
13 – 15	6.1 Highlight the importance of physiological knowledge in guiding fertiliser timing and type selection in horticulture. 6.2 State the importance of transpiration in guiding irrigation scheduling.	• State the importance of physiological knowledge in guiding fertiliser timing and type selection in horticulture. • Discuss the importance of transpiration in guiding irrigation scheduling. • Explain the importance of the knowledge of hormone in propagation, pruning and post-harvest management. • Explain the manipulation of photoperiod as used in commercial flower and	Growth stage nutrient demand table, irrigation scheduling guide, hormone application guide, photoperiod manipulation guide, respiration-storage temperature table, projector.	• Match fertiliser type and rate to the growth stage of one crop on the college farm • Record decision and justification • Use transpiration data to adjust irrigation scheduling for one crop • Record adjustment and outcome • Apply a plant hormone product in one horticultural	Guide students to: • Match fertiliser type and rate to the growth stage of one crop on the college farm • Record decision and justification • Use transpiration data to adjust irrigation scheduling for one crop • Record adjustment and outcome	Growth stage chart, transpiration data, plant hormone product, storage recommendation card template.

6.3 State the importance of the knowledge of hormone in propagation, pruning and post-harvest management. 6.4 Describe the manipulation of photoperiod as used in commercial flower and vegetable production. 6.5 State the importance of the knowledge of respiration in guiding storage temperature and packaging decisions.	vegetable production. • Discuss the importance of the knowledge of respiration in guiding storage temperature and packaging decisions.	operation • Record product, rate, crop and observed effect • Design a photoperiod manipulation experiment for a day-neutral or short-day plant • Prepare a storage recommendation card for three horticultural crops • Record temperature, humidity and expected shelf life	• Apply a plant hormone product in one horticultural operation • Record product, rate, crop and observed effect • Design a photoperiod manipulation experiment for a day-neutral or short-day plant • Prepare a storage recommendation card for three horticultural crops • Record temperature, humidity and expected shelf life
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COURSE ASSESSMENT:
Course work: 10%

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



HORTICULTURAL BUSINESS MANAGEMENT

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: HORTICULTURAL BUSINESS MANAGEMENT	COURSE CODE: HOT 212	CONTACT HOURS: 2 HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PREREQUISITE: NIL	PRACTICAL: 1 HOUR/WEEK
GOAL: This course is designed to equip students with knowledge and skills in planning, managing and growing a horticultural business enterprise.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand agribusiness principles in horticulture; 2.0 Understand enterprise budgeting and financial planning; 3.0 Understand marketing strategies for horticultural produce; 4.0 Understand business planning for a horticultural enterprise; 5.0 Understand human resource management in horticultural businesses; 6.0 Understand agricultural credit and investment in horticultural enterprise.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: HORTICULTURAL BUSINESS MANAGEMENT		COURSE CODE: HOT 212		CONTACT HOURS: 2 HOURS/WEEK		
		CREDIT UNIT: 2		THEORETICAL: 1 HOUR/WEEK		
YEAR: II SEMESTER: I		PREREQUISITE: NIL		PRACTICAL: 1HOUR/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in planning, managing and growing a horticultural business enterprise.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Understand agribusiness principles in horticulture						
1 – 2	1.1 Define agribusiness 1.2 Describe its components in the horticultural value chain. 1.3 Describe the horticultural value chain from input supply to consumer. 1.4 Explain the main actors in the Nigerian horticultural value chain. 1.5 Describe the concept of value addition 1.6 Explain its importance in	- Define agribusiness - Explain its components in the horticultural value chain. - Discuss the horticultural value chain from input supply to consumer. - Highlight the main actors in the Nigerian horticultural value	Horticultural value chain chart, value chain actor list, value addition examples, market information guide, whiteboard, marker, laptop computer,	- Construct a map of the value chain for horticultural crop from the college farm to the consumer - Conduct an interview with a value chain actor (trader, processor or retailer)	Guide students to: - Construct a map of the value chain for horticultural crop from the college farm to the consumer - Conduct an interview with a value chain actor (trader, processor or retailer)	Value chain map template, interview guide, price data form, value chain analysis table template.

	horticulture. 1.7 Explain the role of market information in horticultural business decisions	chain. - Explain the concept of value addition - Discuss its importance in horticulture. - Discuss the role of market information in horticultural business decisions	projector	- Record their role, margin and challenges - Collect price data for horticultural crop at farm gate, wholesale and retail levels - Calculate margin at each level - Identify value addition opportunity for a college farm crop - Describe the process and expected price premium - Prepare a value chain analysis table for horticultural crops grown on the college farm	- Record their role, margin and challenges - Collect price data for horticultural crop at farm gate, wholesale and retail levels - Calculate margin at each level - Identify value addition opportunity for a college farm crop - Describe the process and expected price premium - Prepare a value chain analysis table for horticultural crops grown on the college farm	
General Objective 2.0: Understand enterprise budgeting and financial planning						
3 – 5	2.1 Describe the components of an enterprise budget.	Discuss the components of an	Enterprise budget template,	Prepare an enterprise	Guide students to: Prepare an	Enterprise budget template,

	2.2 Explain the difference between gross margin and net profit. 2.3 Describe preparation of cash flow forecast for a horticultural enterprise. 2.4 Describe break-even analysis and its application in horticultural business decisions. 2.5 Describe the use of financial records to evaluate enterprise performance.	enterprise budget: - Fixed costs, - Variable costs - Gross margin. • Describe the difference between gross margin and net profit. • Explain preparation of cash flow forecast for a horticultural enterprise. • Explain break-even analysis and its application in horticultural business decisions. • Explain the use of financial records to evaluate enterprise performance.	cash flow forecast template, break-even calculation guide, financial performance guide, whiteboard, marker, laptop computer, projector.	budget for horticultural crop • Record all fixed and variable costs, expected yield and gross margin • Prepare a monthly cash flow forecast for one crop cycle • Calculate the break-even yield and break-even price for horticultural enterprise • Prepare an income statement for the college farm for one semester • Record income, costs and net profit • Analyse the financial performance of the college farm	enterprise budget for horticultural crop • Record all fixed and variable costs, expected yield and gross margin • Prepare a monthly cash flow forecast for one crop cycle • Calculate the break-even yield and break-even price for horticultural enterprise • Prepare an income statement for the college farm for one semester • Record income, costs and net profit • Analyse the financial performance of	cash flow forecast template, break-even calculation worksheet, income statement template.
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				enterprise Identify areas for improvement	the college farm enterprise Identify areas for improvement	
General Objective 3.0: Understand marketing strategies for horticultural produce						
6 – 9	3.1 Describe the marketing mix for horticultural produce. 3.2 Describe market segmentation for horticultural produce in Nigeria. 3.3 Describe branding and packaging as marketing tools for horticultural products. 3.4 Describe digital marketing tools. 3.5 Describe steps to negotiate a supply contract with a supermarket or processor	- Explain the marketing mix for horticultural - Produce - Product, - Price, - Place - promotion. - Discuss market segmentation for horticultural produce in Nigeria. - Discuss branding and packaging as marketing tools for horticultural products. - Describe digital marketing tools: - Social media, - WhatsApp Business - e-commerce	4Ps marketing guide, market segmentation diagram, branded product examples, smartphone with WhatsApp Business, sample supply contract, whiteboard, marker, laptop computer, projector.	- Prepare a marketing mix plan for college farm produce describing product, price, place and promotion - Identify market segments for college farm crop describing the product and packaging requirements for each - Design a simple brand label for one college farm produce including product name, farm name, grade and contact	Guide students to: - Prepare a marketing mix plan for college farm produce describing product, price, place and promotion - Identify market segments for college farm crop describing the product and packaging requirements for each - Design a simple brand label for one college farm produce including product name, farm name, grade and contact	Marketing plan template, label design materials, supply contract template.

		platforms. • Explain steps to negotiate a supply contract with a supermarket or processor		• Set up a WhatsApp Business product catalogue for three college farm products including photograph, description and price • Negotiate a mock supply contract with a classmate acting as a buyer • Record agreed terms	• Set up a WhatsApp Business product catalogue for three college farm products including photograph, description and price • Negotiate a mock supply contract with a classmate acting as a buyer • Record agreed terms	
General Objective 4.0: Understand business planning for a horticultural enterprise						
10 – 11	4.1 Describe the components of a business plan. 4.2 Explain the procedure to conduct a SWOT analysis for a horticultural enterprise. 4.3 Explain how to set business objectives and key performance indicators. 4.4 Describe risk assessment and contingency planning	• Explain the components of a business plan: - Executive summary, - Market analysis, - Production plan - Financial projections. • Describe the procedure to	Sample business plan, SWOT analysis template, SMART objective guide, risk assessment template, bank loan requirement	• Conduct a SWOT analysis for the college farm enterprise • Record two items per quadrant with brief explanation • Prepare a market analysis for horticultural crop • Record target	Guide students to: • Conduct a SWOT analysis for the college farm enterprise • Record two items per quadrant with brief explanation • Prepare a market analysis for horticultural crop	SWOT analysis template, market analysis template, SMART objective guide, risk assessment template, business plan

	in a horticultural business plan. 4.5 Explain the use of business plan to access finance from a bank or investor	conduct a SWOT analysis for a horticultural enterprise. - Describe how to set business objectives and key performance indicators. - Explain risk assessment and contingency planning in a horticultural business plan. - Discuss the use of business plan to access finance from a bank or investor	guide, whiteboard, marker, laptop computer, projector.	market, market size, competition and entry strategy - Set three SMART objectives and KPIs for the college farm for the next season - Prepare a risk assessment for the college farm - Identify four risks and one mitigation action for each - Prepare a complete business plan for one horticultural enterprise - Present to the class	- Record target market, market size, competition and entry strategy - Set three SMART objectives and KPIs for the college farm for the next season - Prepare a risk assessment for the college farm - Identify four risks and one mitigation action for each - Prepare a complete business plan for one horticultural enterprise - Present to the class	template.
General Objective 5.0: Understand human resource management in horticultural businesses						
12 – 13	5.1 Describe staffing requirements for a commercial horticultural enterprise. 5.2 Describe how to write a	Explain staffing requirements for a commercial horticultural enterprise.	Farm organogram, Job description template, wage calculation	Prepare an organogram for the college farm showing all roles and reporting	Guide students to: Prepare an organogram for the college farm showing all roles	Farm organogram template, job description template, labour cost

	job description 5.3 Describe how to conduct a simple recruitment process. 5.4 Explain wage setting, piece-rate payment and labour cost management in horticulture. 5.5 Describe worker health, safety and welfare requirements on a horticultural farm. 5.6 Describe how to manage seasonal labour demand in horticultural production.	• Explain how to write a job description • Explain how to conduct a simple recruitment process. • Discuss wage setting, piece-rate payment and labour cost management in horticulture. • Explain worker health, safety and welfare requirements on a horticultural farm. • Explain how to manage seasonal labour demand in horticultural production.	guide, health and safety guide, seasonal labour management guide, whiteboard, marker, computer, projector.	lines • Write a job description for one farm worker role including duties, qualifications and pay • Calculate the total labour cost for one crop cycle on the college farm • Record all worker categories and rates • Complete a health and safety inspection checklist for the college farm • Record findings and actions • Prepare a seasonal labour plan for the college farm specifying number of	and reporting lines • Write a job description for one farm worker role including duties, qualifications and pay • Calculate the total labour cost for one crop cycle on the college farm • Record all worker categories and rates • Complete a health and safety inspection checklist for the college farm • Record findings and actions • Prepare a seasonal labour plan for the college farm specifying	calculation worksheet, health and safety inspection checklist, seasonal labour plan template.
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				workers needed by activity and month	number of workers needed by activity and month	
General Objective 6.0: Understand agricultural credit and investment in horticulture						
14 – 15	6.1 Describe sources of agricultural credit available to horticultural enterprises in Nigeria. 6.2 Explain the requirements for accessing bank loans and government schemes for agriculture. 6.3 Describe equity financing and investor partnerships for horticultural businesses. 6.4 Explain the calculation of return on investment (ROI) for a horticultural enterprise. 6.5 Describe the preparation of a loan application package for a horticultural enterprise	• Discuss sources of agricultural credit available to horticultural enterprises in Nigeria. • Describe the requirements for accessing bank loans and government schemes for agriculture. • Explain equity financing and investor partnerships for horticultural businesses. • Describe the calculation of return on investment (ROI) for a horticultural enterprise. • Explain the preparation of a loan application package	Credit sources guide, sample loan application form, equity financing guide, ROI calculation guide, loan application package checklist, whiteboard, marker, computer, projector.	• Conduct research on two agricultural credit schemes • Record eligibility, loan size, interest rate and repayment period • Calculate ROI for one college farm enterprise for one production cycle • Record all steps • Prepare a loan application package for a hypothetical horticultural enterprise including all required documents • Evaluate the financial viability	Guide students to: • Conduct research on two agricultural credit schemes • Record eligibility, loan size, interest rate and repayment period • Calculate ROI for one college farm enterprise for one production cycle • Record all steps • Prepare a loan application package for a hypothetical horticultural enterprise including all required documents • Evaluate the	Credit scheme research guide, ROI calculation worksheet, loan application package checklist, payback period calculation worksheet.

		investment using a simple payback period calculation • Present the loan application package to the class explaining the enterprise, loan amount requested and repayment plan
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FIELD PRACTICAL II (CONTROLLED PRODUCTION SYSTEMS)

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: FIELD PRACTICAL II (CONTROLLED PRODUCTION SYSTEMS)	COURSE CODE: HOT 213	CONTACT HOURS: 2 HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: NIL
YEAR: II SEMESTER: I	PREREQUISITE: HOT 125	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide students with practical experience in controlled and commercial horticultural production systems.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Apply Controlled Environment Horticulture (CEH) and protected structure crop management; 2.0 Carry out commercial vegetable and fruit crop production; 3.0 Carry out advanced pest and disease management; 4.0 Apply precision irrigation and fertigation; 5.0 Apply quality assurance and post-harvest operations; 6.0 Apply enterprise management skills on the farm.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY

COURSE TITLE: FIELD PRACTICAL II (CONTROLLED PRODUCTION SYSTEMS)	COURSE CODE: HOT 213	CONTACT HOURS: 2HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: NIL
YEAR: II SEMESTER: I	PREREQUISITE: HOT 125	PRACTICAL: 2 HOURS/WEEK

COURSE SPECIFICATION: THEORETICAL AND PRACTICAL

GOAL: This course is designed to provide students with practical experience in controlled and commercial horticultural production systems.

	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources

General Objective 1.0: Apply Controlled Environment Horticulture (CEH) and protected structure crop management

1 – 3			• Carry out all CEH crop management operations for horticultural crops • Monitor climatic conditions inside the CEH structure daily • Apply nutrient solution to the CEH crop at the correct EC and pH • Conduct scouting of the CEH crop for pests and diseases • Harvest the CEH crop at correct maturity	Guide students to: • Carry out all CEH crop management operations for horticultural crops • Monitor climatic conditions inside the CEH structure daily • Apply nutrient solution to the CEH crop at the correct EC and pH • Conduct scouting of the CEH crop for pests and diseases • Harvest the CEH crop at correct maturity	Crop management log, climate monitoring form, EC meter, pH meter, scouting form, yield recording form.
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General Objective 2.0: Apply commercial vegetable and fruit crop production

4 – 8				• Establish commercial crops according to the production plan • Carry out all cultural management practices • Carry out fertiliser application at the correct stage • Monitor crop quality problems observed and corrective actions • Maintain a complete production data record for all crops from establishment to harvest	Guide students to: • Establish commercial crops according to the production plan • Carry out all cultural management practices • Carry out fertiliser application at the correct stage; • Monitor crop quality problems observed and corrective actions • Maintain a complete production data record for all crops from establishment to harvest	Commercial crop seeds or seedlings, fertiliser, stakes, irrigation equipment, management log, production data record form.
General Objective 3.0: Carryout advanced pest and disease management						
9 – 10				• Carry out systematic weekly scouting of horticultural crops • Record pest and disease infestation, percentage damage and action. • Apply organic pesticide to pest-affected crop • Apply chemical pesticide with full PPE • Evaluate the outcome of pest management	Guide students to: • Carry out systematic weekly scouting of horticultural crops Record pest and disease infestation, percentage damage and action. • Apply organic pesticide to pest-affected crop • Apply chemical pesticide with full PPE • Evaluate the outcome of	Scouting form, neem leaves, extraction equipment, PPE set, chemical pesticide, pest management log.

				intervention • Calculate percentage population reduction. • Maintain a complete pest and disease management record.	pest management intervention; calculate percentage population reduction. • Maintain a complete pest and disease management record.	
General Objective 4.0: Apply precision irrigation and fertigation						
10-11				• Operate irrigation system for horticultural crops periodically • Apply fertigation solution to horticultural crops at the scheduled time • Monitor soil moisture or plant water stress periodically; • Carry out routine system maintenance weekly: - Flush laterals, - Check emitters - Clean filters • Maintain a complete irrigation and fertigation record for the crops	Guide students to: • Operate irrigation system for horticultural crops periodically • Apply fertigation solution to horticultural crops at the scheduled time • Monitor soil moisture or plant water stress periodically; • Carry out routine system maintenance weekly: - Flush laterals, - Check emitters - Clean filters • Maintain a complete irrigation and fertigation record for the crops	College farm irrigation system, EC meter, pH meter, moisture monitoring guide, irrigation and fertigation record form.
General Objective 5.0: Apply quality assurance and post-harvest operations						
12-13				• Carry out quality control	Guide students to:	Harvesting tools,

				practices during production. • Conduct harvesting of commercial crops at correct maturity • Sort and grade all harvested produce • Package and label graded produce • Calculate total yield and revenue for each commercial crop • Prepare a season-end harvest and sales report for all crops - Revenue - Gross margin	• Carry out quality control practices during production. • Conduct harvesting of commercial crops at correct maturity • Sort and grade all harvested produce • Package and label graded produce • Calculate total yield and revenue for each commercial crop • Prepare a season-end harvest and sales report for all crops - Revenue - Gross margin	grading containers, packaging materials, weighing scale, yield calculation worksheet, season-end report template.
General Objective 6.0: Apply enterprise management skills on the farm						
14-15				• Carry out farm work team session as team a leader • Record activities assigned, team performance and one lesson learned. • Prepare a farm performance report • Record all crops, yields to date, challenges and	Guide students to: • Carry out farm work team session as team a leader • Record activities assigned, team performance and one lesson learned. • Prepare a farm performance report - Record all crops, yields to	Team leadership record form, midterm report template, peer feedback form, final report template.

			- recommended actions • Give and receive peer feedback with one teammate at midterm • Record two strengths and two improvement areas for each. • Prepare a final farm performance report for the semester • Record all yields, revenue, challenges and recommendations • Present the final farm report to the class explaining performance, challenges and plan for the next cycle.	- date, challenges and recommended actions • Give and receive peer feedback with one teammate at midterm - Record two strengths and two improvement areas for each. • Prepare a final farm performance report for the semester • Record all yields, revenue, challenges and recommendations • Present the final farm report to the class explaining performance, challenges and plan for the next cycle.	
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%					

POST-HARVEST HANDLING OF HORTICULTURAL CROPS

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: POST-HARVEST HANDLING OF HORTICULTURAL CROPS	COURSE CODE: HOT 214	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in post-harvest handling, storage and value addition of horticultural crops.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand post-harvest losses and their causes; 2.0 Know harvesting and field handling practices; 3.0 Know sorting, grading and packaging of horticultural produce; 4.0 Know storage methods for horticultural crops; 5.0 Know value addition to horticultural crops; 6.0 Understand marketing of fresh horticultural produce;		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: POST-HARVEST HANDLING OF HORTICULTURAL CROPS			COURSE CODE: HOT 214		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PREREQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in post-harvest handling, storage and value addition of horticultural crops.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Understand post-harvest losses and their causes						
1 – 2	1.1 Define post-harvest losses. 1.2 Explain the economic significance of post-harvest loss in Nigeria. 1.3 Explain the causes of postharvest losses. 1.4 Explain biological causes of losses. 1.5 Explain physical causes of losses. 1.6 Explain physiological	- Explain post-harvest losses. - Discuss the economic significance of post-harvest loss in Nigeria. - Describe the causes of postharvest losses. - Describe biological causes of losses: - Respiration, - Transpiration - Ripening.	Nigerian loss data, respiration diagram, damaged produce photographs, disorder photographs, prevention guide, projector. Laptop computers, internet, smart board, projector,	- Conduct a survey on post-harvest losses in a local market - Record crop estimated percentage loss and probable cause for five crops. - Measure respiration rate of harvested tomato and pepper - Record temperatures and weight loss over a period of time for each sample. - Identify five	Guide students to: - Conduct a survey on post-harvest losses in a local market - Record crop estimated percentage loss and probable cause for five crops. - Measure respiration rate of harvested tomato and pepper, - Record temperatures and	Market survey form, weighing scale, pepper sample, tomato samples, cold storage access, damaged produce samples, loss reduction plan template.

	disorders. 1.7 Describe preventive measures to reduce post-harvest losses at each stage of the supply chain.	- Describe physical causes of losses. - Describe physiological disorders: - Chilling injury, - Sunscald - Internal breakdown. - Discuss preventive measures to reduce post-harvest losses at each stage of the supply chain.	writing material.	examples of mechanical damage on produce in the college farm or market. - Identify chilling injury symptoms on stored fruit - Record findings. - Develop a post-harvest loss reduction plan for one crop. - Identify three loss points - Recommend one action each.	weight loss over a period of time for each sample. - Identify five examples of mechanical damage on produce in the college farm or market. - Identify chilling injury symptoms on stored fruit - Record findings. - Develop a post-harvest loss reduction plan for one crop. - Identify three loss points - Recommend one action each.	
General Objective 2.0: Know harvesting and field handling practices						
2 – 3	2.1 Explain maturity indices for various horticultural crops. 2.2 Explain harvesting tools 2.3 Explain the correct	- Describe maturity indices for various horticultural crops. - Describe harvesting tools - Describe the	Maturity index colour chart, field packing guide, pre-cooling diagram,	- Harvest various horticultural crops from the college farm at correct maturity - Record signs assessed and tool used for each	Guide students to: Harvest various horticultural crops from the college farm at correct maturity	College farm produce, harvesting tools, cleaning tools, field containers, cushioning

	harvesting technique for each crop type. 2.4 Explain field sanitation practices to reduce post-harvest contamination. 2.5 Explain field packing and pre-cooling methods after harvest. 2.6 Highlight the transport requirements for fresh horticultural produce.	correct harvesting technique for each crop type. • Discuss field sanitation practices to reduce post-harvest contamination. • Describe field packing and pre-cooling methods after harvest. • Explain the transport requirements for fresh horticultural produce.	transport guide, projector, Journal, textbooks, Internet computer	• Carry out field sorting after harvest. • Record percentage marketable and percentage rejected for each crop. • Demonstrate correct container handling and cleaning • Record cleaning procedure and materials used. • Pack harvested produce into field containers with correct cushioning using padding material. • Transport packed produce from the field to the store • Record time, handling method and condition on arrival at the store.	• Record signs assessed and tool used for each • Carry out field sorting after harvest. • Record percentage marketable and percentage rejected for each crop. • Demonstrate correct container handling and cleaning • Record cleaning procedure and materials used. • Pack harvested produce into field containers with correct cushioning using padding material. • Transport packed produce from the field to the store • Record time, handling method and condition on arrival at the store.	material, cleaning equipment.
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General Objective 3.0: Know sorting, grading and packaging of horticultural produce						
3 – 6	3.1 Define sorting, grading and packaging of horticultural produce. 3.2 Enumerate sorting criteria. 3.3 Explain grading standards for fresh vegetables and fruit for local and export markets. 3.4 List packaging materials for fresh produce. 3.5 Explain labelling requirements. 3.6 Explain quality control checks at the packing house.	• Explain sorting, grading and packaging of horticultural produce. • Discuss sorting criteria: - Removal of diseased, damaged and immature produce. • Describe grading standards for fresh vegetables and fruit for local and export markets. • Explain packaging materials for fresh produce: - Cartons, - Crates, - Nets - Polythene bags. • Discuss labelling requirements: - Crop name, - Grade,	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries, Journals Mixed tomato batch, quality control checklist,	• Sort a mixed batch of produce • Record marketable quantity, quantity rejected and rejection percentage. • Grade sorted produce into two classes • Record quantity per grade and grading criteria applied. • Pack graded produce into appropriate packaging • Record material used, quantity per pack and cost per kilogram. • Prepare and attach a complete label to packed produce • Record each label element included. • Carry out a quality control check on three packed boxes	Guide students to: • Sort a mixed batch of produce • Record marketable quantity, quantity rejected and rejection percentage. • Grade sorted produce into two classes • Record quantity per grade and grading criteria applied. • Pack graded produce into appropriate packaging • Record material used, quantity per pack and cost per kilogram. • Prepare and attach a complete label to packed produce • Record each label	Mixed produce batch, grading containers, packaging materials, perishable sample, tomato, label template, quality control checklist, worksheet Educational QC reader.

		- Weight, - Farm name, date, - Barcode, etc. • Describe quality control checks at the packing house.		• Record findings	- element included. • Carry out a quality control check on three packed boxes • Record findings	
General Objective 4.0: Know storage methods for horticultural crops						
7 – 9	4.1 Define ambient storage. 4.2 State the limitations of ambient storage for tropical horticultural crops. 4.3 Explain evaporative cooling storage. 4.4 Explain cold room storage. 4.5 Explain controlled atmosphere storage. 4.6 Explain appropriate storage methods for ten horticultural crops	• Define ambient storage. • Explain the limitations of ambient storage for tropical horticultural crops. • Describe evaporative cooling storage: - Clay pot cooler - Zero-energy cool room construction. • Describe cold room storage: - Temperature - Humidity requirements for different crops.	Temperature and humidity table, cold storage requirements table, CA storage guide, projector.	• Construct a clay pot evaporative cooler • Record inside and outside temperature three times daily for 3 days. • Store equal quantities of a crop in the cooler and in ambient conditions • Compare quality at 1, 3 and 5 days. • Measure temperature and humidity in a cold room or refrigerator • Compare with recommended levels for one crop • Prepare a storage recommendation	Guide students to: • Construct a clay pot evaporative cooler; • Record inside and outside temperature three times daily for 3 days. • Store equal quantities of a crop in the cooler and in ambient conditions • Compare quality at 1, 3 and 5 days. • Measure temperature and humidity in a cold room or	Clay pots, wet sand, wet cloth, thermometer, hygrometer, produce for storage, storage recommendation table template.

		- Describe controlled atmosphere storage: - Gas composition - Suitable fruit types. - Describe appropriate storage methods for ten horticultural crops		table for ten crops - Record method, temperature, humidity and expected shelf life. - Calculate the storage loss percentage for a batch of produce stored for one week - Record all measurements	refrigerator - Compare with recommended levels for one crop - Prepare a storage recommendation table for ten crops - Record method, temperature, humidity and expected shelf life. - Calculate the storage loss percentage for a batch of produce stored for one week - Record all measurements	
General Objective 5.0: Know value addition to horticultural crops						
10 – 12	5.1 Define value addition. 5.2 Explain Drying and Dehydration. 5.3 Explain the techniques for	- Explain value addition. - Discuss Drying and Dehydration. - Discuss the techniques for	Textbooks Articles Computer Projector White board Marker Educational	- Set up a solar drier. - Produce dried vegetable chips or fruit leather using the appropriate drying or dehydration	Guide students to: - Set up a solar drier. - Produce dried vegetable chips or	Solar drier, juicer, jam making Cabinet dryer, solar dryer, Blanching baskets,

drying and dehydration of horticultural crops. 5.4 Explain juice and puree production from fruits and vegetables. 5.5 Explain jam and marmalade production from fruit. 5.6 Explain pickling and fermentation of vegetables	drying and dehydration of horticultural crops. - Describe juice and puree production from fruits and vegetables. - Describe jam and marmalade production from fruit. - Describe pickling and fermentation of vegetables	Videos or Documentaries Journals Processing flowcharts, Projector. Solar drier, projector.	techniques. - Prepare fresh juice from one fruit crop of the season. - Prepare tomato paste - Record ingredients, process steps, final yield and shelf life achieved. - Prepare a batch of jam or marmalade; - Record ingredients, sugar ratio, cooking time and final yield. - Pickle a batch of vegetables - Record vegetables used, brine concentration, date and sensory quality at 7 days	fruit leather using the appropriate drying or dehydration techniques. - Prepare fresh juice from one fruit crop of the season. - Prepare tomato paste - Record ingredients, process steps, final yield and shelf life achieved. - Prepare a batch of jam or marmalade; - Record ingredients, sugar ratio, cooking time and final yield. - Pickle a batch of vegetables - Record vegetables used, brine concentration, date and sensory quality at 7 days	pickling jars, slicers, tomato, pepper, fruit samples, sugar, salt, vinegar, weighing scale.
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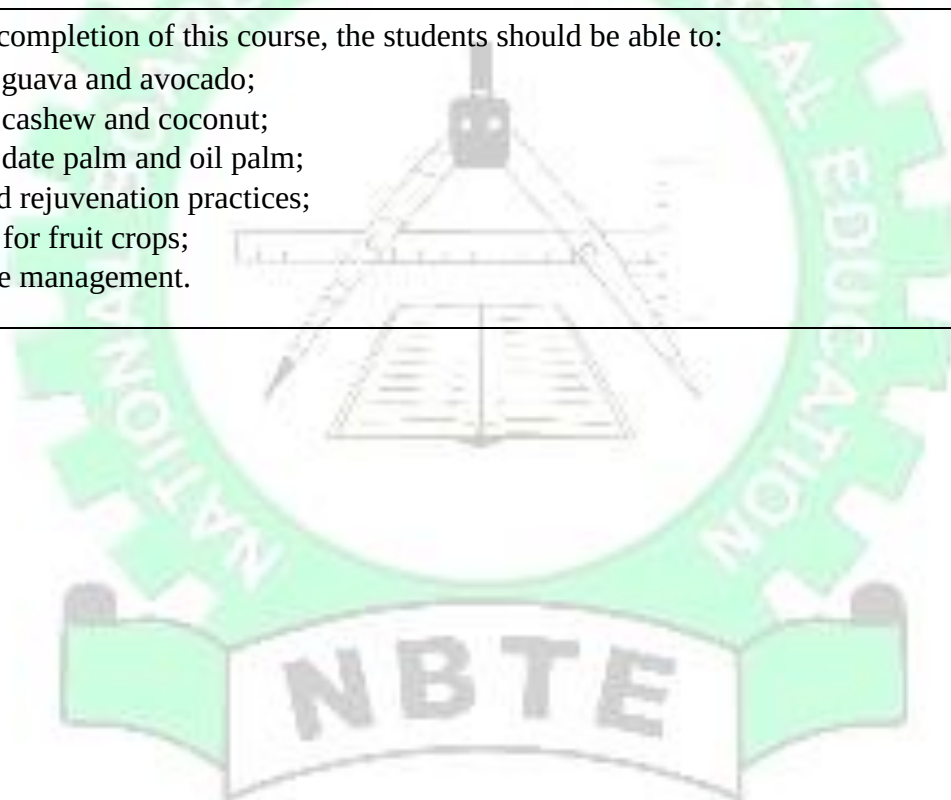
General Objective 6.0: Understand marketing of fresh horticultural produce

13 – 15	6.1 Explain the fresh horticultural produce marketing chain in Nigeria from farm to consumer. 6.2 Explain marketing channels. 6.3 Explain the selling price. 6.4 Explain supply contract negotiation. 6.5 Explain digital platforms used to market fresh produce.	• Describe the fresh horticultural produce marketing chain in Nigeria from farm to consumer. • Describe marketing channels: - Farm gate, - Wholesale - Markets, - Supermarkets - Direct export. • Discuss the selling price: - Cost of production margin - Market price determination. • Describe supply contract negotiation. • Discuss digital platforms used to market fresh produce: - WhatsApp - Instagram	Marketing chain diagram, channel comparison table, pricing worksheet, sample supply contract, smartphone, projector.	• Construct a marketing chain map for one horticultural crop from the college farm to the consumer • Record each stage and actor • Calculate the selling price for one produce lot • Record all cost items, margin applied and final price per kilogram • Visit a wholesale market • Record five prices for the same crop • Calculate the average and price range • Prepare a simple supply contract for a hypothetical buyer • Record produce type, grade, quantity, price and delivery terms	Guide students to: • Construct a marketing chain map for one horticultural crop from the college farm to the consumer • Record each stage and actor • Calculate the selling price for one produce lot • Record all cost items, margin applied and final price per kilogram • Visit a wholesale market • Record five prices for the same crop • Calculate the average and price range • Prepare a simple supply contract for a hypothetical buyer	Marketing chain template, pricing worksheet, price recording form, supply contract template,
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COURSE ASSESSMENT:	
Course work:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%

FRUIT CROP PRODUCTION II

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY			
COURSE TITLE: FRUIT CROP PRODUCTION II	COURSE CODE: HOT 215	CONTACT HOURS: 3 HOURS/WEEK	
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I	PREREQUISITE: 115	PRACTICAL: 2 HOURS/WEEK	
GOAL: This course is designed to equip students with knowledge and skills in the production of tropical and minor fruit crops in Nigeria			
GENERAL OBJECTIVES: On completion of this course, the students should be able to:			
1.0 Know production practices for guava and avocado;			
2.0 Know production practices for cashew and coconut;			
3.0 Know production practices for date palm and oil palm;			
4.0 Know orchard management and rejuvenation practices;			
5.0 Know post-harvest technology for fruit crops;			
6.0 Understand fruit crop enterprise management.			



PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: FRUIT CROP PRODUCTION II			COURSE CODE: HOT 215		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PREREQUISITE: HOT 115		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in the production of tropical and minor fruit crops in Nigeria.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Know production practices for guava and avocado						
1 – 2	1.1 Explain the botany of guava 1.2 Explain the agronomic requirements of guava. 1.3 Explain land preparation for guava. 1.4 Explain guava propagation. 1.5 Explain guava cultural management. 1.6 Describe the botany and agronomic requirements of avocado.	• Discuss the botany of guava • Describe the agronomic requirements of guava: - Soil, - pH, - Climate, etc. • Describe land preparation for guava. • Describe guava propagation: - Seed, - Nursery,	Guava and avocado propagation guide, projector, white board, computer, internet.	• Carry out layering on a guava plant. • Apply fertiliser to guava trees by ring method. • Carry out pruning of guava trees. • Conduct scouting of guava and avocado trees for pests and diseases. • Harvest guava at correct maturity	Guide students to: • Carry out layering on a guava plant. • Apply fertiliser to guava trees by ring method. • Carry out pruning of guava trees. • Conduct scouting of guava and avocado trees for pests and diseases. • Harvest guava at correct maturity	Guava and avocado trees, sphagnum moss, polythene strips, fertiliser, pruning shears, scouting form.

	1.7 Explain avocado production.	- Cuttings, - Layering - Budding. • Describe guava cultural management: - Fertiliser, - Pruning, - Irrigation, - Weed control, etc. • Discuss the botany and agronomic requirements of avocado: - Soil, - pH, - Climate - Spacing. • Describe avocado production: - Budding, - Spacing, - Fertiliser - Maturity indices				
General Objective 2.0: Know production practices for cashew and coconut						
3-5	2.1 Explain the botany	• Describe the botany	Crop tables,	• Plant cashew	Guide students to:	Cashew

	and agronomic requirements of cashew. 2.2 Describe cashew production. 2.3 Explain cashew nut processing. 2.4 Explain the botany of coconut. 2.5 Describe the agronomic requirements of coconut. 2.6 Explain coconut production.	and agronomic requirements of cashew: - Soil, - Climate - Spacing. • Discuss cashew production: - Propagation, - Planting, - Fertiliser - Weed management. • Describe cashew nut processing: - Shelling, - Drying - Grading. • Describe the botany of coconut. • Discuss the agronomic requirements of coconut: - Soil, - Climate - Spacing. • Describe coconut production:	production calendars, nut processing photographs, projector.	seedlings at correct spacing. • Apply post-harvest care. • Apply fertiliser to cashew trees • Record fertilizer type, rate, date and method of application. • Process a batch of raw cashew nuts: - Shell, - Dry - Grade • Record starting weight, yield and defect percentage. • Apply fertiliser to coconut palms; • Record fertilizer type, rate and method of application. • Plant coconut seedlings at correct spacing. • Harvest coconuts at correct maturity	• Plant cashew seedlings at correct spacing. • Apply post-harvest care. • Apply fertiliser to cashew trees • Record fertilizer type, rate, date and method of application. • Process a batch of raw cashew nuts: - Shell, - Dry - Grade • Record starting weight, yield and defect percentage. • Apply fertiliser to coconut palms; • Record fertilizer type, rate and method of application. • Plant coconut seedlings at correct spacing. • Harvest coconuts at	seedlings, coconut palms, fertiliser, cashew nut processing tools, weighing scale.
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		- Planting, - Fertiliser, - Water management - Harvesting.		• Record date, number harvested and average nut weight	correct maturity • Record date, number harvested and average nut weight	
General Objective 3.0: Know production practices for date palm and oil palm						
6 – 8	3.1 Explain the botany and agronomic requirements of date palm. 3.2 Describe date palm production. 3.3 Explain the botany of oil palm. 3.4 Describe agronomic requirements of oil palm. 3.5 Describe oil palm production. 3.6 Explain maturity indices and harvesting of date palm and oil palm bunches.	• Describe the botany and agronomic requirements of date palm: - Climate, - Soil - Spacing. • Describe date palm production: - Offshoot selection, - Sex identification, - Nursery raising, - Field planting, - Post planting operations (weeding, fertiliser application, crop protection etc.).	Date palm and oil palm photographs, crop tables, production guides, maturity index photographs, projector.	• Identify male and female date palms on the college farm • Record sex type and location for each. • Raise oil palm sprouted nuts to oil palm seedlings. • Transplant oil palm seedlings to field at correct spacing • Carry out post-planting maintenance - Supplying, - Weeding, - Fertilizer application, - Crop protection etc. • Harvest oil palm bunch at correct	Guide students to: • Identify male and female date palms on the college farm • Record sex type and location for each. • Raise oil palm sprouted nuts to oil palm seedlings. • Transplant oil palm seedlings to field at correct spacing • Carry out post-planting maintenance - Supplying, - Weeding, - Fertilizer application, - Crop protection etc. • Harvest oil palm	Date palm, sprouted nuts, polybags oil palm trees, fertiliser, weeding tools, scouting form, harvesting sickle weighing scale.

		- Describe the botany of oil palm. - Discuss agronomic requirements of oil palm: - Soil, - Climate - Spacing. - Discuss oil palm production: - Nursery raising, - Field planting - Post planting operations (weeding, fertiliser, crop protection etc.) - Discuss maturity indices and harvesting of date palm and oil palm bunches.		maturity.	bunch at correct maturity.	
General Objective 4.0: Know orchard management and rejuvenation practices						
9-10	4.1 Explain orchard floor management. 4.2 Highlight pruning objectives and types. 4.3 Explain the	- Discuss orchard floor management: - Cover cropping, - Mulching	Orchard floor management photographs, pruning diagrams, rejuvenation	- Apply mulch to the base of orchard trees - Carry out pruning on trees. - Rejuvenate neglected trees on the college	Guide students to: - Apply mulch to the base of orchard trees - Carry out pruning on trees.	Mulch materials, pruning shears, intercrop seeds or

	management of old and neglected orchards. 4.4 Explain intercropping and agroforestry in fruit orchards giving suitable crops and benefits. 4.5 Describe record keeping in orchard management.	- Controlled weeding. • Discuss pruning objectives and types: - Formative, - Maintenance - Rejuvenation pruning. • Describe the management of old and neglected orchards: - Assessment - Rejuvenation steps. • Describe intercropping and agroforestry in fruit orchards giving suitable crops and benefits. • Discuss record keeping in orchard management: - Planting records, - Input records - Yield records.	guide, intercropping examples, sample record forms, projector.	farm. • Carry out intercrop establishment between orchard trees • Complete a one-month orchard management record covering all operations, inputs and observations	• Rejuvenate neglected trees on the college farm. • Carry out intercrop establishment between orchard trees • Complete a one-month orchard management record covering all operations, inputs and observations	seedlings, orchard management record form.
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General Objective 5.0: Know post-harvest technology for fruit crops

11 – 12	5.1 Explain the implications of postharvest. 5.2 Explain postharvest treatments for fresh fruit. 5.3 List packaging materials for fresh fruit export. 5.4 Explain packaging methods for fresh fruit. 5.5 Explain fruit processing options. 5.6 Explain cold storage requirements for fresh fruit	- Discuss the implications of postharvest: - Ripening physiology of climacteric and non-climacteric fruits. - Describe postharvest treatments for fresh fruit: - Waxing, - Fungicide dip - Calcium treatment. - Describe packaging materials for fresh fruit export: - Cartons, - Cushioning. - Describe packaging methods for fresh fruit: - Labelling	Ripening physiology diagram, waxing materials, export carton example, drying trays, cold storage data, projector.	- Apply wax or fungicide dip treatment to a batch of harvested fruits. - Pack fruits in an export carton with cushioning with a complete label. - Prepare dried mango or pawpaw. - Prepare a batch of fresh fruit juice: - Weigh, - Extract, - Strain - Bottle. - Store horticultural fruits in three different cold storage structures under varied cold temperatures - Refrigerator 4-12°C, - Freezer 0°C, - Cold room (50-80°C) - Compare with	Guide students to: - Apply wax or fungicide dip treatment to a batch of harvested fruits. - Pack fruits in an export carton with cushioning with a complete label. - Prepare dried mango or pawpaw. - Prepare a batch of fresh fruit juice: - Weigh, - Extract, - Strain - Bottle. - Store horticultural fruits in three different cold storage structures under varied cold temperatures - Refrigerator 4-12°C, - Freezer 0°C, - Cold room (50-80°C)	Harvested fruits, wax or fungicide, export carton, cushioning material, labels, drying trays, juicer, bottles, weighing scale, cold storage structures.
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		- Describe fruit processing options: - Drying, - Juicing, - Jam making - Canning. - Describe cold storage requirements for fresh fruit: - Temperature, - Humidity - Duration		ambient temperature(28°C-36°C).	Compare with ambient temperature(28°C-36°C).	
General Objective 6.0: Understand fruit crop enterprise management						
13 – 15	6.1 Explain enterprise budgeting for a fruit crop. 6.2 Explain marketing strategies for fruit crops. 6.3 Explain steps to register and certify a fruit farm for export. 6.4 Explain steps to access agricultural credit for fruit crop enterprise in Nigeria. 6.5 Explain the use of	- Describe enterprise budgeting for a fruit crop: - Costs, - Expected yield - Gross margin. - Describe marketing strategies for fruit crops: - Direct sales, - Processors - Export.	Enterprise budget template, marketing guide, certification checklist, credit access guide, smartphone, projector.	- Prepare an enterprise budget for horticultural fruit crop per hectare - Record all costs, expected yield and gross margin - Develop a marketing plan for the college farm fruit produce - Identify three channels and target customers	Guide students to: - Prepare an enterprise budget for horticultural fruit crop per hectare - Record all costs, expected yield and gross margin - Develop a marketing plan for the college farm fruit produce - Identify three channels and target	Enterprise budget template, marketing plan template, certification checklist, credit research guide.

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

POST-HARVEST HANDLING OF HORTICULTURAL CROPS

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO BEVERAGES AND MEDICINAL PLANTS	COURSE CODE: HOT 216	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNITS: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide student with knowledge and skills of beverages and medicinal plants.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the major classification and identification properties of important beverage and medicinal plants; 2.0 Know the origin and distribution of important beverages and medicinal plants; 3.0 Know the beverages and medicinal properties of the plants; 4.0 Know the economic importance of beverage and medicinal plants; 5.0 Understand methods of collection and processing of beverage and medicinal plants; 6.0 Know preservation and storage techniques of beverage and medicinal plants.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO BEVERAGES AND MEDICINAL PLANTS			COURSE CODE: HOT 216		CONTACT HOURS: 3HOURS/WEEK	
			CREDIT UNITS: 3		THEORETICAL: 1HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills of beverages and medicinal plants.						
GENERAL OBJECTIVE 1.0: Know the major classification and identification properties of important beverage and medicinal plants.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources

1 – 2	1.1 Explain the major beverage and medicinal plants. 1.2 Explain the morphology of beverage and medicinal plants. 1.3 Explain the classification of beverage and medicinal plants from family to species levels. 1.4 State the botanical, common and local names of beverages and medicinal plants.	• Define beverage and medicinal plants with specific examples. • Discuss the botany of beverage and medicinal plants in terms of flowers, seeds, bulbs, roots, leaves, stems, bark, twigs, etc. • Discuss the classification of beverage and medicinal plants. • Explain the botanical, common and local names of beverage and medicinal plants.	Whiteboard, marker, LCD projector and laptop computer, internet.	• Identify the important beverage and medicinal plants in Nigeria. • Identify different morphological and structural features of the plants. • Identify different beverage and medicinal plants.	Guide students to: • Identify important beverage and medicinal plants. • Identify different morphological features of the plants. • Identify different beverage and medicinal plants.	Samples of beverages (e.g., tea, coffee, cocoa) and medicinal plants (e.g., moringa, garlic).
General Objective 2.0: Understand Good Agricultural Practices in horticultural production						
4 – 5	2.1 Explain the origin of beverage and	• Discuss the origin of	Whiteboard, markers, LCD	• Identify habitats of beverages and	Guide students to identify habitats of beverage and	Quadrant. Mortar, pestle,

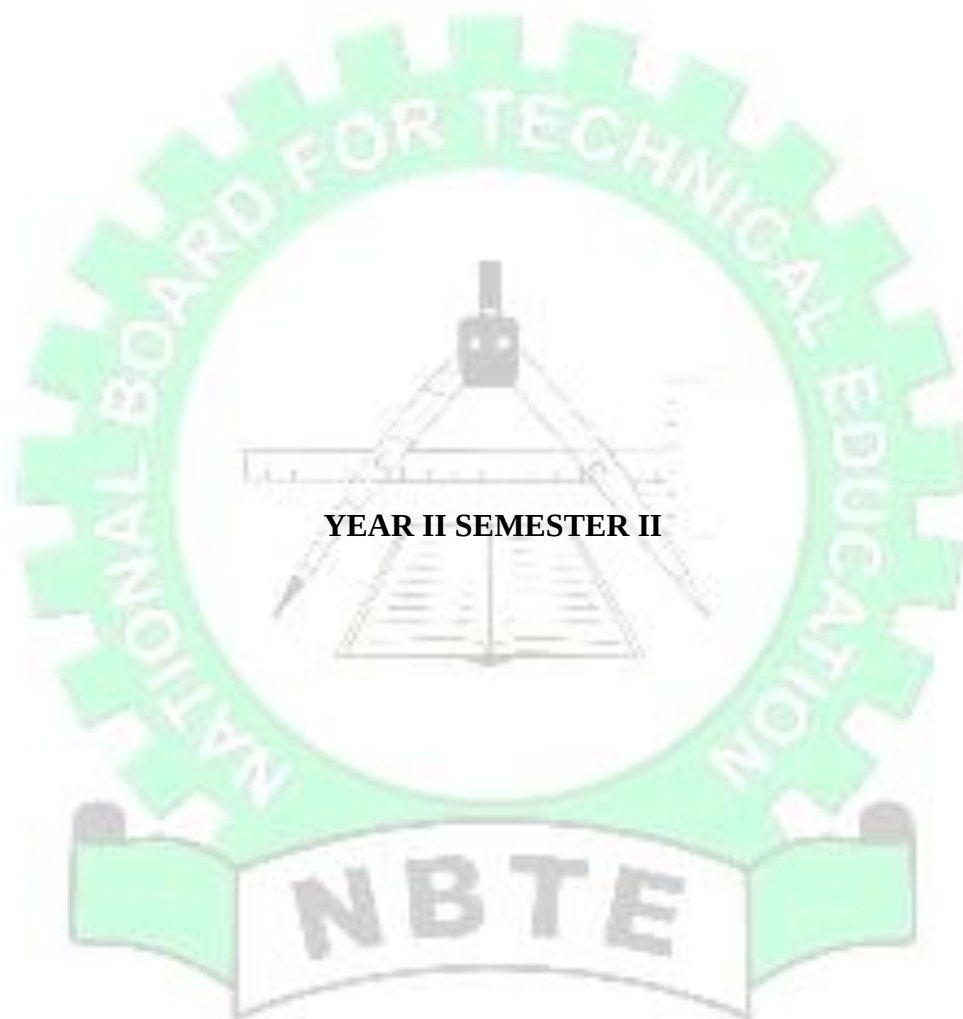
	medicinal plants. 2.2 Explain the abundance and distribution of beverage and medicinal plants.	beverage and medicinal plants in relation to habitat. • Discuss the abundance and distribution of beverage and medicinal plants.	projector, laptop computer, maps, charts.	medicinal plants.	medicinal plants.	muslin cloth, beakers, test tubes, kolanut, Aloe vera ointment/syrup, Eucalyptus oil, garlic Coffee, tea, kolanut, lemon grass, citrus
General Objective 3.0: Know Global G.A.P certification requirements						
6 – 8	3.1 Explain the properties of plants classified as medicinal plants. 3.2 Explain the properties of plants classified as beverages.	- Discuss the medicinal component and other compounds in medicinal plant. - Discuss the beverage property of the plants	LCD projector, laptop computer, whiteboard, markers, charts.	- Identify the medicinal properties of the plant. - Identify the beverage properties of the plant.	Guide students to: - Identify the medicinal properties of the plants. - Identify the medicinal properties of the plants.	Mortar, pestle, muslin cloth, beakers, test tubes, kolanut, Aloe vera ointment/syrup, Eucalyptus oil, garlic Coffee, tea, kolanut, lemon grass, citrus.
General Objective 4.0: Know food safety management systems in post-harvest operations						
9 – 10	4.1 Explain the economic importance of beverage and medicinal plants in terms of	Discuss the economic contribution in disease prevention and	LCD projector, Laptop computer, whiteboard, marker, charts.			

	prevention and cure of major and minor ailments. 4.2 Explain the economic contribution of the beverage and medicinal plants in terms of abundance and sustainability. 4.3 Explain the roles of beverage and medicinal plants in the local and national economy.	cure. • Discuss the availability and sustainability of beverage and medicinal plants. • Discuss the contribution of specific beverage and medicinal plants to the local and national economy of Nigeria.				
General Objective 5.0: Understand export market requirements for Nigerian horticultural produce						
11 – 12	5.1 Explain the plant parts and methods of collection of beverage and medicinal plants. 5.2 Explain the methods of processing beverage and medicinal plants.	• Discuss the parts for collection, stage of collection and methods of collecting beverage and medicinal plants.	Whiteboard, marker, LCD projector, laptop computer.	• Collect differentiate important parts of beverage and medicinal plants. • Identify major processing equipment and methods for beverage and	Guide students to: • Collect beverage and medicinal plants, e.g., bark, roots, stems, flowers, etc. • Demonstrate processing of the plants	Autoclave, sedimenter desiccators, oven, shade, Jars, bottles, packets, polyethylene bags.

		- Discuss the implements, equipment and methods of processing the plants.		- medicinal plants. - Process important parts collected		
General Objective 6.0: Know traceability and documentation systems for export compliance						
13 – 15	6.1 Explain the methods of preservation of beverage and medicinal plants. 6.2 List the materials used in preservation of the beverage and medicinal plants. 6.3 Explain methods and materials of storage of beverage and medicinal plants.	- Discuss the techniques of preservation of the plants. - Explain the materials used in preservation of beverage and medicinal plants. - Describe the materials and methods of storing beverage and medicinal plants.	White board, marker, LCD projector, laptop computer, pictures.	- Identify techniques of preservation of the plants. - Identify materials used in preservation. - Identify materials and methods of storing beverage and medicinal plants.	Guide students to: - Identify techniques of preservation of the plants. - Identify materials used in preservation. - Identify materials and methods of storing beverage and medicinal plants.	Solar drier, desiccators, oven, shade, Jars, bottles, packets, polyethylene bags.
COURSE ASSESSMENT:						

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





POST-HARVEST TECHNOLOGY AND VALUE ADDITION

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: POST-HARVEST TECHNOLOGY AND VALUE ADDITION	COURSE CODE: HOT 221	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PREREQUISITE: HOT 214	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in post-harvest technology and value addition for horticultural crops.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know post-harvest handling and storage technologies; 2.0 Understand fruit and vegetable processing and preservation; 3.0 Understand quality control and food safety in post-harvest operations; 4.0 Understand packaging technology for horticultural produce; 5.0 Understand post-harvest supply chain management; 6.0 Understand value addition enterprise management.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: POST-HARVEST TECHNOLOGY AND VALUE ADDITION			COURSE CODE: HOT 221		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PREREQUISITE: HOT 214		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in post-harvest technology and value addition for horticultural crops.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Know post-harvest handling and storage technologies						
1 – 2	1.1 Describe the role of plant hormones in ripening and senescence on horticultural produce. 1.2 Outline factors affecting quality of produce during postharvest handling operations 1.3 Describe losses that occur during poor postharvest handling. 1.4 Describe cold chain	- Explain the role of plant hormones (ethylene, auxin, etc.) in ripening and senescence. - Explain factors affecting quality of produce during postharvest handling operations	Laptop computers, smart board, projector, whiteboard, markers, internet Ethylene production graph, Sample data tables MAP film, cold chain record form,	- Conduct ethylene production using simple chemical or sensor-based methods. - Identify factors affecting quality of produce during postharvest handling operations. - Measure water loss (transpiration) under different humidity and temperature. - Set up a MAP	- Conduct ethylene production using simple chemical or sensor-based methods. - Identify factors affecting quality of produce during postharvest handling operations - Measure water loss (transpiration) under different humidity and temperature. - Carry out MAP quality assessment	Ethylene sensor (handheld) or KMnO ₂ Ripening agents Digital scale, Humidity chambers, Fruit Samples, Vegetable samples, MAP film, Ethylene absorber sachets,

fruit and vegetable processing and preservation

3 – 5	2.1 Describe thermal processing of horticultural produce. 2.2 Describe drying and dehydration. 2.3 Describe fermentation and pickling of vegetables. 2.4 Describe jam, jelly and marmalade production from fruit. 2.5 Describe juice and puree production.	• Explain thermal processing of horticultural produce: blanching, pasteurisation and canning. • Discuss drying and dehydration: sun drying, solar drying and mechanical drying. • Explain fermentation and pickling of vegetables. • Explain jam, jelly and marmalade production from fruit. • Discuss juice and puree production: extraction, pasteurisation and bottling	Projector. Smart Phone, Computer, Internet, Text Books Journals	• Blanch and sun-dry one vegetable • Record starting weight, final weight, drying time and moisture content • Prepare a batch of pickled vegetables • Record vegetables used, brine concentration, date and quality at 7 days • Prepare fruit jam • Record fruit type, sugar ratio, cooking time, final yield and sensory quality • Extract and bottle fresh fruit juice • Record yield per kilogram, cost per litre and sensory quality • Calculate the value added by processing one crop • Record fresh price, processed price and	Guide students to: • Blanch and sun-dry one vegetable • Record starting weight, final weight, drying time and moisture content • Prepare a batch of pickled vegetables • Record vegetables used, brine concentration, date and quality at 7 days • Prepare fruit jam • Record fruit type, sugar ratio, cooking time, final yield and sensory quality • Extract and bottle fresh fruit juice • Record yield per kilogram, cost per litre and sensory quality • Calculate the value added by processing one crop • Record fresh price, processed price and	Vegetables For Drying and Pickling, Fruit for Jam and Juice, Sugar, Salt, Vinegar, Blanching Pot, Solar Drier, Jars, Bottles, Weighing Scale, Field Notebooks.
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				value addition margin	value addition margin	
General Objective 3.0: Apply quality control and food safety in post-harvest operations						
6 – 7	3.1 Explain food safety hazards in post-harvest handling. 3.2 Explain Hazard Analysis and Critical Control Point (HACCP) principles 3.3 Explain their application in a horticultural packing house. 3.4 Explain personal hygiene and facility sanitation requirements. 3.5 Explain maximum residue limits (MRLs) and their compliances. 3.6 Explain traceability	- Describe food safety hazards in post-harvest handling: - Biological, - Chemical - Physical hazards. - Describe Hazard Analysis and Critical Control Point (HACCP) principles - Describe their application in a horticultural packing house. - Describe	Food Safety Hazard Guide, HACCP Chart, Hygiene Checklist, MRL Reference Table, Traceability Record Template, Projector, Smart Board, Computer Text Books	- Complete a food safety audit checklist for the college packing area - Record non-compliant points and corrective actions - Develop a simple HACCP plan for a selected postharvest operation in the college farm - Record findings - Carry out a facility hygiene inspection - Record cleaning procedures, materials used and hygiene status - Check two pesticides used on the college	Guide students to: - Complete a food safety audit checklist for the college packing area - Record non-compliant points and corrective actions - Develop a simple HACCP plan for a selected postharvest operation in the college farm - Record findings - Carry out a facility hygiene inspection - Record cleaning procedures, materials used and hygiene status - Check two pesticides	HACCP worksheet, Hygiene inspection form, MRL Reference table, traceability record template.

	systems for fresh horticultural produce.	personal hygiene and facility sanitation requirements - Describe maximum residue limits (MRLs) and their compliances. - Discuss traceability systems for fresh horticultural produce.		farm against the MRL database - Record compliance status for each - Prepare a traceability record for one produce lot from field to dispatch	used on the college farm against the MRL database - Record compliance status for each - Prepare a traceability record for one produce lot from field to dispatch	
General Objective 4.0: Understand packaging technology for horticultural produce						
8 – 9	4.1 Explain packaging functions. 4.2 Explain packaging materials used in horticulture 4.3 Describe labelling requirements for fresh and processed horticultural products. 4.4 Explain packaging line operations in a	- Describe packaging functions - Discuss packaging materials used in horticulture. - Discuss labelling requirements for fresh and processed horticultural	Labelled product examples, Packing house flow diagram, Sustainable packaging guide, projector, Smart board, Marker, Computer,	- Select appropriate packaging for three horticultural crops - Record material, reason for selection and estimated cost - Design a label for one processed horticultural product. - Pack ten units of one fresh crop in export cartons with correct	Guide students to: - Select appropriate packaging for three horticultural crops - Record material, reason for selection and estimated cost - Design a label for one processed horticultural product. - Pack ten units of one	Packaging materials, Label design materials, Export cartons, Cushioning material, Produce samples, Weighing scale.

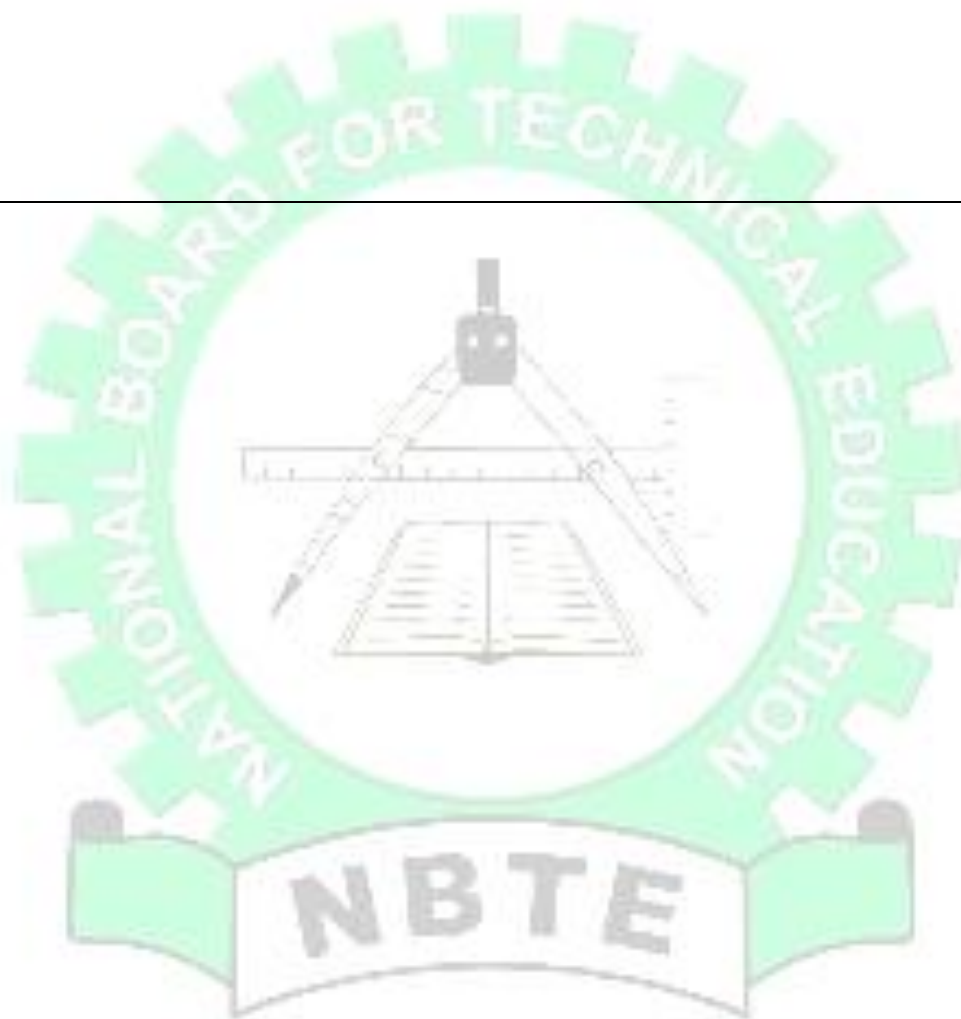
	commercial packing house. 4.5 Describe sustainable packaging options and their relevance to Nigerian horticulture.	products. • Discuss packaging line operations in a commercial packing house. • Discuss sustainable packaging options and their relevance to Nigerian horticulture.	Internet.	cushioning • Record carton weight and cost per unit • Compare the shelf life of produce in two different packaging materials; • Record quality at 3 and 5 days • Prepare a packaging cost analysis for one crop • Record material cost, labour cost and total packaging cost per kilogram	fresh crop in export cartons with correct cushioning • Record carton weight and cost per unit • Compare the shelf life of produce in two different packaging materials; • Record quality at 3 and 5 days • Prepare a packaging cost analysis for one crop • Record material cost, labour cost and total packaging cost per kilogram	
General Objective 5.0: Understand post-harvest supply chain management						
10 – 11	5.1 Explain the structure of the Nigerian horticultural supply chain from farm to consumer. 5.2 Explain the roles and margins of each supply chain actor.	• Discuss the structure of the Nigerian horticultural supply chain from farm to consumer. • Discuss the roles and margins of each supply chain	Supply chain flow diagram, price build-up table, Coordination mechanism guide, Loss reduction guide, Digital	• Construct a supply chain map for one college farm crop from field to consumer • Record each actor and their margin • Calculate the total margin and price build-up from farm	• Construct a supply chain map for one college farm crop from field to consumer • Record each actor and their margin Guide students to: • Calculate the total margin and price build-up from farm gate to	Supply chain map template, Price build-up worksheet, Loss reduction guide, Digital platform research guide, Improvement

	5.3 Explain supply chain coordination. 5.4 Explain how to reduce supply chain losses using better coordination and infrastructure. 5.5 Explain how digital platforms are improving horticultural supply chain efficiency in Nigeria.	actor. • Describe supply chain coordination. • Discuss how to reduce supply chain losses using better coordination and infrastructure • Discuss how digital platforms are improving horticultural supply chain efficiency in Nigeria.	platform examples, Projector.	gate to retail for one crop • Identify three supply chain loss points for one crop • Recommend one loss reduction action for each • Conduct research on one digital platform that connects horticultural producers with buyers in Nigeria • Record services and how to join • Prepare a supply chain improvement plan for the college farm • Identify two weaknesses proposing solutions	retail for one crop • Identify three supply chain loss points for one crop • Recommend one loss reduction action for each • Conduct research on one digital platform that connects horticultural producers with buyers in Nigeria • Record services and how to join • Prepare a supply chain improvement plan for the college farm • Identify two weaknesses proposing solutions	plan template.
General Objective 6.0: Understand value addition enterprise management						
12 – 15	6.1 Describe enterprise planning for a small-scale horticultural processing	• Explain enterprise planning with a sample processing	Cost and pricing calculation guide, Journal,	• Prepare an enterprise plan for a small tomato paste processing business • Record equipment,	Guide students to: • Prepare an enterprise plan for a small tomato paste processing business	Business plan template Cost and pricing worksheet,

	business. 6.2 Describe the equipment, space and utilities required for a small processing unit. 6.3 Explain how to calculate cost of production and selling price for a processed product. 6.4 Describe marketing strategies for processed horticultural products in Nigeria. 6.5 Describe regulatory requirements for processed food products: NAFDAC, SON registration and labelling	business plan • Explain equipment and utility requirements for a small processing unit • Explain cost of production and pricing calculation for one product • Describe marketing strategies for processed products with Nigerian examples • Explain NAFDAC, SON registration steps and labelling requirements	Internet, Computer, Smart board, Markers, Marketing strategy guide, NAFDAC registration guide, Projector.	costs and expected income • Calculate cost of production and selling price for one processed product from the college farm • Prepare packaging and labels for five units of one processed product • Record all label elements included • Develop a marketing plan for one processed product • Identify two channels describing the promotion strategy • Prepare a NAFDAC registration checklist for one processed horticultural product • Record all required steps	• Record equipment, costs and expected income • Calculate cost of production and selling price for one processed product from the college farm • Prepare packaging and labels for five units of one processed product • Record all label elements included • Develop a marketing plan for one processed product • Identify two channels describing the promotion strategy • Prepare a NAFDAC registration checklist for one processed horticultural product • Record all required steps	Packaging materials, Label materials, Marketing plan template, NAFDAC registration checklist.
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COURSE ASSESSMENT:

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



EXPORT STANDARDS AND FOOD SAFETY COMPLIANCE

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: EXPORT STANDARDS AND FOOD SAFETY COMPLIANCE	COURSE CODE: HOT 222	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is design to equip students with knowledge and skills to produce horticultural crops in compliance with export standards and food safety requirements.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand international food safety standards for horticultural produce; 2.0 Understand Good Agricultural Practices (G.A.P) in horticultural production; 3.0 Know Global G.A.P certification requirements; 4.0 Know food safety management systems in post-harvest operations; 5.0 Understand export market requirements for Nigerian horticultural produce; 6.0 Know traceability and documentation systems for export compliance.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY

COURSE TITLE: EXPORT STANDARDS AND FOOD SAFETY COMPLIANCE		COURSE CODE: HOT 222	CONTACT HOURS: 3 HOURS/WEEK
		CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II	SEMESTER: II	PREREQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK

COURSE SPECIFICATION: THEORETICAL AND PRACTICAL

GOAL: This course is design to equip students with knowledge and skills to produce horticultural crops in compliance with export standards and food safety requirements.

	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources

General Objective 1.0: Understand international food safety standards for horticultural produce



1 – 2	1.1 Describe the Codex Alimentarius standards relevant to fresh horticultural produce 1.2 Describe EU, UK and US food safety import requirements for fresh vegetables and fruit 1.3 Explain Maximum Residue Limit (MRL) setting process and enforcement mechanism 1.4 Describe microbiological standards for fresh horticultural produce 1.5 Explain the consequences of non-compliance with import food safety standards	• Explain the role Codex Alimentarius with relevant standards for fresh produce • Explain the role of EU, UK and US import requirements • Describe MRL setting process and enforcement mechanism • Explain microbiological standards for fresh produce • Discuss consequences of non-compliance with import rejection case studies	Textbooks, Articles, Computers, Projector, White board Marker, Educational Videos or Documentaries, Journals, Regulatory gazettes, Codex Alimentarius summary, EU import requirement documents, MRL database, Microbiological standards table, Import rejection case studies.	• Conduct research on EU MRL limits for two pesticides used on the college farm • Record limits and compliance status • Identify three microbiological hazards relevant to one college farm crop • Record source and control measure for each • Review a mock import rejection notice • Identify the reason for rejection recommending corrective actions • Prepare a food safety compliance checklist for one college farm crop targeting the EU market • Compare Nigerian NAFDAC	Guide students to: • Conduct research on EU MRL limits for two pesticides used on the college farm • Record limits and compliance status • Identify three microbiological hazards relevant to one college farm crop • Record source and control measure for each • Review a mock import rejection notice • Identify the reason for rejection recommending corrective actions • Prepare a food safety compliance checklist for one college farm crop targeting the EU market	MRL database, EU import requirement documents, Mock rejection notice, Compliance checklist template, NAFDAC, SON standards, Regulatory gazettes,
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				standards with EU standards for one produce	Compare Nigerian NAFDAC standards with EU standards for one produce	
General Objective 2.0: Understand Good Agricultural Practices in horticultural production						
3 – 5	2.1 Discuss the principles of Good Agricultural Practices (GAP) for horticultural crops 2.2 Describe GAP requirements for site history, risk assessment and soil management 2.3 Describe GAP	• Explain GAP principles with a GAP framework overview • Explain site history and risk assessment requirements • Explain water quality testing and irrigation management	GAP framework guide Site risk assessment form Water quality test kit, Worker hygiene checklist, GAP record forms, Projector	• Complete a site risk assessment for the college farm • Record identified risks and mitigation measures • Test irrigation water quality on the college farm • Record pH, EC and turbidity	Guide Student to: • Complete a site risk assessment for the college farm • Record identified risks and mitigation measures. • Test irrigation water quality on the college farm	Water test kit, Worker hygiene checklist, PPE,

	requirements for water quality testing and irrigation management 2.4 Describe GAP requirements for worker health, hygiene and welfare 2.5 Explain GAP record keeping with sample record forms	requirements • Explain worker health, hygiene and welfare requirements • Describe GAP record keeping requirements: field records, input records and worker records		• Compare with GAP requirements • Complete a worker hygiene inspection checklist for the college farm • Record compliant and non-compliant points • Maintain a complete GAP field record for one crop for two weeks • Record all inputs, operations and observations • Prepare a corrective action plan for two GAP non-compliances identified on the college farm	• Record pH, EC and turbidity; compare with GAP requirements and record findings • Carry out worker hygiene inspection checklist for the college farm • Record compliant and non-compliant points and report findings • Provide field record form and guide data entry • Carry out corrective action planning and report findings	
General Objective 3.0: Know Global G.A.P certification requirements						
6 – 8	3.1 Describe the Global G.A.P certification scheme: structure, modules and applicable crops	• Explain Global G.A.P structure, modules and applicable crops	Global G.A.P CPCC checklist, Internal audit guide, Certification steps timeline,	• Complete a Global G.A.P CPCC self-assessment for the college farm	Guide students to: • Complete a Global G.A.P CPCC self-assessment for	Global G.A.P CPCC checklist, Internal audit recording form,

	3.2 Describe the Global G.A.P Control Points and Compliance Criteria. (CPCC) module requirements for horticultural producers 3.3 Describe the Global G.A.P internal audit process and corrective action procedure 3.4 Describe the steps for a producer to achieve Global G.A.P certification 3.5 Explain the costs and benefits of Global G.A.P certification for Nigerian horticultural farmers	• Explain CPCC module requirements with a checklist walkthrough • Explain internal audit process and corrective action procedure • Outline the certification steps with timeline and cost • Discuss costs and benefits with Nigerian farmer case studies	Cost and benefit case studies, Projector, Internet Multimedia White board Computer	• Conduct a mock internal audit of the college farm using the Global G.A.P checklist • Prepare a corrective action plan for three non-conformances identified in the mock audit • Prepare a certification readiness report for the college farm • Rate compliance level • Identify remaining gaps	the college farm • Conduct a mock internal audit of the college farm using the Global G.A.P checklist • Prepare a corrective action plan for three non-conformances identified in the mock audit • Prepare a certification readiness report for the college farm • Rate compliance level • Identify remaining gaps	
General Objective 4.0: Know food safety management systems in post-harvest operations						
9 – 10	4.1 Describe Hazard Analysis and Critical Control	• Explain Hazard Analysis and Critical Control	HACCP packing house flow diagram,	• Prepare a HACCP plan for the college farm	Guide students to: • Prepare a	HACCP plan template, CCP monitoring forms, Sanitation inspection

	Point (HACCP) principles applied to a horticultural packing house 4.2 Explain the identification of critical control points in post-harvest operations 4.3 Describe monitoring procedures and corrective actions at each CCP 4.4 Describe facility design and sanitation requirements for a compliant packing house 4.5 Outline training procedure for packing house workers on food safety procedures	Point (HACCP) principles applied to a horticultural packing house • Explain the identification of critical control points in post-harvest operations • Discuss monitoring procedures and corrective actions at each CCP • Explain facility design and sanitation requirements for a compliant packing house • Explain training procedure for packing house workers on food safety procedures	HACCP chart, CCP identification worksheet, Monitoring and corrective action forms, Facility sanitation guide, Worker training guide, Smart board, computer Text books Projector.	packing area • Identify hazards, CCPs and control measures • Carry out CCP monitoring during one packing session • Record monitoring results and any corrective actions taken • Complete a facility sanitation inspection of the college packing area • Record findings and corrective actions • Deliver a five-minute food safety briefing to classmates acting as packing workers. • Prepare a packing house food safety record for one packing session	HACCP plan for the college farm packing area. • Identify hazards, CCPs and control measures. • Carry out CCP monitoring during one packing session. • Record monitoring results and any corrective actions taken. • Complete a facility sanitation inspection of the college packing area. • Record findings and corrective actions. • Deliver a five-minute food safety briefing to classmates acting as packing workers. • Prepare a packing	form, Food safety record form.
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					house food safety record for one packing session	
General Objective 5.0: Understand export market requirements for Nigerian horticultural produce						
11 – 12	5.1 Explain Nigerian horticultural export opportunities: crops, destination markets and volumes 5.2 Describe the export documentation required for fresh horticultural produce 5.3 Describe the role of NEPC, NAFDAC and NCS in supporting horticultural exports 5.4 Describe packaging and labelling requirements for export markets 5.5 Describe how to find and qualify export buyers for Nigerian horticultural produce	- Describe export opportunities with trade data by crop and market - Explain export documentation with sample documents - Explain the role of each export agency and how to access their services - Explain packaging and labelling requirements for EU and Gulf markets - Describe buyer identification channels - Demonstrate NEPC and B2B	Nigerian export trade data, Sample export documents, Export packaging guide, NEPC website, B2B platform, Laptop, Internet, Smart board, Markers, Projector.	- Conduct research on the export requirements for two Nigerian horticultural crops - Record destination, standards and certification needed - Prepare a complete mock export documentation package for one consignment - Identify two potential export buyers for one Nigerian crop using NEPC or an online B2B platform - Design export packaging and labelling for one	Guide student to: - Conduct research on the export requirements for two Nigerian horticultural crops - Record destination, standards and certification needed - Prepare a complete mock export documentation package for one consignment - Identify two potential export buyers for one Nigerian crop using NEPC or an online B2B platform - Design export	Export requirements guide, Document templates, NEPC website, B2B platform, EU packaging requirements, FOB calculation worksheet,

		platform use		Nigerian horticultural product targeting the EU market • Calculate the FOB export price for one crop • Record farm gate price, processing, packaging and certification costs	packaging and labelling for one Nigerian horticultural product targeting the EU market • Calculate the FOB export price for one crop • Record farm gate price, processing, packaging and certification costs	
General Objective 6.0: Know traceability and documentation systems for export compliance						
13 – 15	6.1 Describe the importance of traceability in export horticultural supply chains 6.2 Describe how to establish a farm-to-fork traceability system for fresh produce 6.3 Describe digital traceability tools: barcodes, QR codes and block chain 6.4 Describe the	• Explain traceability importance with import rejection and recall examples • Explain farm-to-fork traceability system for fresh produce • Explain digital traceability tools; demonstrate QR code generation for a produce lot • Explain	Traceability flow diagram, digital traceability tools, QR code generator, Traceability record template, product recall procedure guide, projector. Textbooks Articles Computer Projector White board Marker	• Set up a traceability system for one college farm crop • Assign lot numbers • Prepare a traceability flow chart • Prepare a complete traceability record for one produce lot from planting to dispatch.	Guide students to: • Set up a traceability system for one college farm crop • Assign lot numbers • Prepare a traceability flow chart • Prepare a complete traceability record for one	Traceability record template, QR code generator app, Traceability software,

	documentation requirements for a complete traceability record	documentation requirements for a complete traceability record	Educational Videos or Documentaries Journals Traceability software	• Generate a QR code for one produce lot linking it to a traceability record • Scan and verify the information • Respond to a mock product recall scenario • Record the steps taken to identify and withdraw the affected lot • Prepare a traceability audit trail for one export consignment • Record all documentation from field to ship	produce lot from planting to dispatch. • Generate a QR code for one produce lot linking it to a traceability record • Scan and verify the information • Respond to a mock product recall scenario • Record the steps taken to identify and withdraw the affected lot • Prepare a traceability audit trail for one export consignment • Record all documentation from field to ship
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COURSE ASSESSMENT:
 Course work: 10%
 Test/Assignments: 10%

Practical:	40%
Examination:	40%
Total:	100%



LANDSCAPING DESIGN AND URBAN HORTICULTURE

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: LANDSCAPING DESIGN AND URBAN HORTICULTURE	COURSE CODE: HOT 223	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PREREQUISITE: HOT 116	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is design to equip students with knowledge and skills in professional landscape design, installation and urban horticulture.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand professional landscape design principles and techniques; 2.0 Understand landscape installation and project management; 3.0 Understand urban horticulture systems; 4.0 Understand landscape maintenance management; 5.0 Understand landscape business operations and client management; 6.0 Understand sustainable landscape design practice.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: LANDSCAPING DESIGN & URBAN HORTICULTURE			COURSE CODE: HOT 223		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PREREQUISITE: HOT 116		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is design to equip students with knowledge and skills in professional landscape design, installation and urban horticulture.						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Understand professional landscape design principles and techniques						
1 – 3	1.1 Explain the professional landscape design process: client brief, site analysis, concept design and detailed design 1.2 Describe advanced design principles: plant massing, seasonal interest, colour theory and texture contrast 1.3 Describe how to prepare a professional design drawing using scale, symbols and notation 1.4 Describe how to prepare a planting plan and plant	• Discuss the design process with a real project example • Explain advanced design principles with portfolio photographs • Explain preparation of professional scaled drawing on graph paper • Explain preparation of planting plan and	Real project portfolio, Design principal photographs, White Board Computer, Projector.	• Conduct a client brief interview using a standard form taking note of client requirements and preferences • Carry out a professional site analysis for the college grounds • Record dimensions, existing features, sun path and soil • Prepare a concept design sketch for the site	Guide students to: • Conduct a client brief interview using a standard form taking note of client requirements and preferences • Carry out a professional site analysis for the college grounds • Record dimensions, existing features, sun path and soil	Measuring tape, Graph paper, rulers, Planting plan template, BOQ template, Current plant and material price list.

	schedule for a landscape project 1.5 Describe how to prepare a bill of quantities and cost estimate for a landscape project	plant schedule • Explain preparation of Bill of quantity (BOQ) and cost estimate		• Annotate proposed zones, materials and plant types • Produce a finished scaled planting plan on graph paper including all species with circle sizes and labels • Prepare a complete BOQ and cost estimate for the project	• Prepare a concept design sketch for the site • Annotate proposed zones, materials and plant types • Produce a finished scaled planting plan on graph paper including all species with circle sizes and labels • Prepare a complete BOQ and cost estimate for the project	
General Objective 2.0: Understand landscape installation and project management						
4 – 6	2.1 Explain landscape installation sequence: site clearance, earthworks, hardscape, planting and finishing 2.2 Describe how to prepare a project implementation schedule using a Gantt chart. 2.3 Explain material	• Discuss installation sequence with a project flow diagram • Discuss Gantt chart preparation for a landscape project	Installation flow diagram, Gantt chart template, Procurement checklist, Projector, Computer, White Board.	• Prepare Gantt chart template; • Procure planting materials for the campus project check quality against specifications • Lead a landscape	Guide students to: • Prepare Gantt chart template • Procure planting materials for the campus project • Supervise all installation	Gantt chart template, procurement checklist, planting materials, Landscape installation tools, Handover

	procurement and quality control during landscape installation. 3.1 Describe how to supervise a landscape installation team. 3.2 Describe how to inspect and hand over a completed landscape project to a client.	• Describe material procurement and quality checks during installation • Discuss team supervision during installation • Discuss inspection and handover procedure with a checklist		installation team for one session; record activities assigned, team performance and lesson learned • Install all proposed elements of the campus landscape project; record all installation steps and date completed • Carry out a final inspection and prepare a handover checklist for the completed campus project	activities.	checklist.
General Objective 3.0: Urban horticulture systems						
7 – 9	3.1 Explain urban horticulture systems 3.2 Describe the structural requirements for rooftop gardens: weight loading, waterproofing and drainage. 3.3 Describe suitable crops and plants for rooftop and vertical growing in Nigerian cities. 3.4 Explain the management	• Discuss urban horticulture systems • Describe structural requirements for rooftop gardens • List suitable crops and plants for urban growing • Describe	Urban horticulture system photographs, rooftop garden structural guide, Suitable crop list, Urban space management guide, Case studies,	• Design a rooftop container garden for a 20 m² area • Sketch layout, list plants and estimate weight load • Establish a vertical growing unit or container garden on the college campus • Manage the urban growing unit for two	• Guide students to: • Design a rooftop container garden in the college • Establish a vertical growing unit or container garden on the college campus • Carry out management	Containers, growing medium, Urban crop seeds or seedlings, Vertical growing frame, Watering equipment, Design

	of urban green spaces. 3.5 Explain the social and economic benefits of urban horticulture in Nigerian cities.	management of urban green spaces • Discuss social and economic benefits with case studies	Projector.	weeks: water, fertilise, scout for pests, etc • Harvest produce from the urban unit • Prepare a cost-benefit analysis for the urban growing unit • Record establishment cost, produce value and net outcome.	practices • Harvest crop and calculate yield • Prepare cost-benefit analysis for the urban growing unit	template, cost-benefit template.
General Objective 4.0: Understand landscape maintenance management						
10 – 11	4.1 Explain how to develop a comprehensive landscape maintenance programme 4.2 Describe maintenance operations and their frequency: mowing, pruning, fertilising and irrigation. 4.3 Explain how to diagnose and manage common landscape plant problems. 4.4 Explain how to manage a landscape maintenance team and schedule	• Describe maintenance programme development with a sample monthly schedule. • Discuss each operation with frequency guide for Nigerian climate. • Discuss plant problem diagnosis. • Describe team management and	Monthly maintenance schedule, maintenance operation frequency guide, Plant problem photographs, work order template, Client maintenance report Template, Projector.	• Prepare a 12-month maintenance programme for the college campus landscape • Specify all operations and frequency. • Carry out a complete maintenance session on the campus landscape. • Diagnose two plant problems in the campus landscape • Record symptom,	Guide students to: • Prepare a 12-month maintenance programme for the college campus landscape • Carry out a complete maintenance session on the campus landscape • Diagnose two plant problems in	Maintenance tools, Plant problem photographs, work order template.

	operations 4.5 Explain how to prepare a landscape maintenance report for a client.	scheduling with a work order example. Discuss client maintenance report preparation.		probable cause and recommended action - Prepare a work order for one maintenance session - Record all tasks, team members assigned and time allocated - Prepare a client maintenance report for one month on the campus landscape	the campus landscape - Prepare a work order for one maintenance session - Prepare a client maintenance report	
General Objective 5.0: Understand landscape business operations and client management						
12 – 13	5.1 Describe how to set up and register a landscape contracting business in Nigeria 5.2 Explain how to prepare a competitive landscape quotation for a client 5.3 Explain how to manage client relationships and handle complaints professionally 5.4 Describe how to market landscape services: portfolio, referrals and social media	- Explain business setup and CAC registration steps - Discuss quotation preparation for a sample landscape project - Explain client relationship and complaint management	CAC registration guide, Quotation template, Client management guide, Portfolio examples, Social media marketing guide, Cash flow template, Projector,	- Prepare a professional quotation for a hypothetical landscape project - Develop a digital portfolio of college campus landscape work; include photographs and project descriptions - Role-play a client complaint scenario - Record the complaint, response	Guide students to: - Prepare a professional quotation for a landscape project - Develop digital portfolio - Handle Client complaints resolution - Prepare a one-page landscape business marketing plan. - Prepare cash flow	Quotation template, Smartphone for portfolio photographs, Client complaint role-play Scenario, marketing plan template, Cash flow template.

	5.5 Describe how to manage cash flow and profitability in a landscape business	• Explain landscape business marketing with portfolio and social media examples • Discuss cash flow management for a seasonal landscape business	White Board, Computer.	and resolution reached • Prepare a one-page landscape business marketing plan • Specify channels, content and budget • Prepare a six-month cash flow forecast for a hypothetical landscape business	for landscape enterprise	
General Objective 6.0: Understand sustainable landscape design practices						
14 – 15	6.1 Describe sustainable landscape design principles: water efficiency, native plants, reduced chemicals and biodiversity 6.2 Explain rainwater harvesting and greywater recycling in landscape design 6.3 Explain the use of native and drought-tolerant plants in sustainable Nigerian landscapes 6.4 Describe composting	• Explain sustainable design principles with Nigerian landscape examples • Explain rainwater harvesting and greywater recycling systems • Discuss native and drought-tolerant plants	Projector, Computer, White Marker Board, Video clips,	• Redesign one section of the college campus landscape using sustainable design principles • Sketch and annotate the design • Install a small rainwater harvesting tank or greywater reuse system on the campus • Replace two non-native ornamentals	Guide students to: • Redesign a section of the college campus landscape using sustainable design principles • Install small rainwater harvesting tank or greywater reuse system on the campus • Carry out non-native ornamentals with	Sustainable design template, Rainwater tank or greywater components, Native plant list, Compost and mulch materials.

ess	landscapes • Explain composting and mulching in landscape management • Discuss environmental performance assessment for a landscape	native or drought-tolerant species • Apply compost and mulch to the campus landscape beds • Record material, rate, area and date • Complete an environmental performance assessment for the college campus landscape.	• •
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HORTICULTURAL AGRIBUSINESS AND DIGITAL MARKET ACCESS

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY		
COURSE TITLE: HORTICULTURAL AGRIBUSINESS AND DIGITAL MARKET ACCESS	COURSE CODE: HOT 224	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PREREQUISITE: HOT 212	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills to access markets, build agribusiness enterprises in the horticultural sector through the integration of digital tools		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand digital tools for horticultural market access; 2.0 Apply e-commerce and online selling for horticultural produce; 3.0 Know digital marketing strategies for horticultural businesses; 4.0 Understand contract farming and outgrower schemes; 5.0 Understand export marketing for Nigerian horticultural produce; 6.0 Develop a digital agribusiness plan for a horticultural enterprise.		

PROGRAMME: NATIONAL DIPLOMA (ND) IN HORTICULTURAL TECHNOLOGY						
COURSE TITLE: HORTICULTURAL AGRIBUSINESS AND DIGITAL MARKET ACCESS			COURSE CODE: HOT 224		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PREREQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills to access markets, build agribusiness enterprises in the horticultural sector through the integration of digital tools						
	THEORETICAL CONTENT			PRACTICAL CONTENT		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
General Objective 1.0: Understand digital tools for horticultural market access						
1 – 2	1.1 Outline digital platforms used for horticultural market access and agribusiness support in Nigerian, e.g. Farmcrowdy, Thrive Agric and AgroMall. 1.2 Explain the use of WhatsApp	- Explain digital platforms used for horticultural market access and agribusiness support in Nigerian, e.g. Farmcrowdy, Thrive Agric and AgroMall. - Discuss the use of WhatsApp Business for horticultural market access. - Explain how to use price information apps and SMS market	Smartphone, Price information app, Spreadsheet template, Projector, White Board, Computer.	- Set up a WhatsApp Business account for a college farm product - Create a complete profile and add five products - Conduct research on Nigerian agri-digital platforms - Record services, fee structure and how to register - Use a price information app or website to collect	Guide students to: - Set up a WhatsApp Business account for a college farm product - Create a complete profile and add five products - Conduct research on Nigerian agri-digital platforms - Record services, fee structure and how to register - Use a price information	Smartphones , WhatsApp Business, Price information application or website.

Business for horticultural market access.	information services.	prices for horticultural crops	app or website to collect prices for horticultural crops
1.3 Describe how to use price information apps and SMS market information services.	• Discuss the importance of digital literacy for horticultural agribusiness success.	• Record and compare with local prices	• Record and compare with local prices
1.4 Explain the importance of digital literacy for horticultural agribusiness success.	• Explain data management and record keeping using mobile apps and spreadsheets.	• Transcribe one week of college farm records into a spreadsheet	• Transcribe one week of college farm records into a spreadsheet
1.5 Describe data management and record keeping using mobile apps and spreadsheets.	• Explain digital record-keeping systems for horticultural enterprises.	• Record inputs, operations and yields • Present a digital market access strategy for one college farm crop to the class	• Record inputs, operations and yields • Present a digital market access strategy for one college farm crop to the class
1.6 Describe digital record-keeping systems for horticultural enterprises.			

General Objective 2.0: Apply e-commerce and online selling for horticultural produce

3 – 5	2.1 Explain e-commerce models for horticultural produce: B2C, B2B and farm-to-table platforms. 2.2 Describe listing and selling of horticultural products using digital market places and online selling platforms. 2.3 Explain the sequence of packaging, labeling and delivery requirements for online horticultural sales. 2.4 Describe management of online	• Discuss e-commerce models with Nigerian horticultural examples • Discuss the sequence of product listing on Jumia, Jiji, Instagram shop, etc. • Explain online sales packaging and delivery requirements • Discuss order management and customer communication • Explain delivery cost calculation and pricing	Smartphone, Jumia, Instagram app, etc., delivery cost calculator, online order management guide, projector. MoU	• Generate a list of farm products from the college farm on an online platform including picture album, description, price and delivery terms • Prepare a packaging and label for an online order; • Record packaging material, label content and total cost • Calculate delivery cost for three order sizes to three different distances • Record all calculations • List response to a mock customer enquiry about a produce order; • Record the enquiry, response and outcome • Prepare a monthly online sales record: • Record all orders, income, packaging and delivery costs and net income	Guide students to: • Generate a list of farm products from the college farm on an online platform including picture album, description, price and delivery terms • Prepare a packaging and label for an online order; • Record packaging material, label content and total cost • Calculate delivery cost for three order sizes to three different distances • Record all calculations • List response to a mock customer enquiry about a produce order; • Record the enquiry, response and outcome • Prepare a monthly online sales record: • Record all orders, income, packaging and delivery costs and net income	Smartphone, Packaging materials, Label template, Delivery cost calculator.
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	orders, customer communication and payment.					
	2.5 Explain how to calculate delivery costs and include them in online pricing					
General Objective 3.0: Know digital marketing strategies for horticultural businesses						
6 – 7	3.1 Describe digital marketing channels used in horticultural enterprises. 3.2 Describe the sequence of engaging content for horticultural digital marketing. 3.3 Describe the	- Explain digital marketing channels used in horticultural enterprises. - Discuss the sequence of engaging content for horticultural digital marketing. - Explain the sequence of basic social media advertising: - Boosting posts - Targeting audiences.	Smartphone, Facebook, Instagram, TikTok applications, marketing metrics guide, customer management guide, projector.	- Create three social media posts for one college farm product including digital photo album, caption and hashtags for each - Boost a post on Facebook or Instagram for one day - Record audience targeted, reach and engagement achieved - Record content metrics for three posts over one	Guide students to: - Create three social media posts for one college farm product including digital photo album, caption and hashtags for each - Boost a post on Facebook or Instagram for one day - Record audience targeted, reach and engagement achieved - Record content metrics	Content creation guide, Metrics recording form, Marketing calendar template.

	sequence of basic social media advertising. 3.4 Explain how to measure the effectiveness of digital marketing campaigns. 3.5 Describe the sequence of building a digitilised customer base and manage customer relationships. 3.6 Describe customer relationship management (CRM) in horticultural enterprises. 3.7 Explain market intelligence and digital market research for	• Describe how to measure the effectiveness of digital marketing campaigns. • Discuss the sequence of building a digitilised customer base and manage customer relationships. • Discuss customer relationship management (CRM) in horticultural enterprises. • Explain market intelligence and digital market research for horticultural products.		week: - Reach, - Likes, - Comments - Enquiries generated • Respond to five mock customer enquiries via social media • Prepare a one-month digital marketing calendar for the college farm specifying platform, content type and posting frequency • Collect and analyse market prices for horticultural products from digital and local market sources.	for three posts over one week: - Reach, - Likes, - Comments - Enquiries generated • Respond to five mock customer enquiries via social media • Prepare a one-month digital marketing calendar for the college farm specifying platform, content type and posting frequency • Collect and analyse market prices for horticultural products from digital and local market sources.	
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	horticultural products.					
General Objective 4.0: Understand contract farming and outgrower schemes						
8 – 10	4.1 Define contract farming 4.2 Explain its main models in Nigerian horticulture. 4.3 Explain the benefits of contract farming for smallholder horticultural farmers. 4.4 Describe the risks of contract farming and farmers protection. 4.5 Explain the key clauses in a typical horticultural production contract. 4.6 Outline the	• Explain contract farming • Describe its main models in Nigerian horticulture. • Discuss the benefits of contract farming for smallholder horticultural farmers. • Explain the risks of contract farming and farmers protection. • Describe the key clauses in a typical horticultural production contract. • Explain the identification process • Explain aggregation systems for horticultural produce marketing in Nigeria.	Nigerian contract farming case studies, sample production contract, contract clause guide, contract partner identification guide, projector.	• Read and annotate a sample horticultural production contract • Identify five key clauses explaining each • Identify one contract farming opportunity for a college farm crop • Record the company, crop required and entry requirements • Simulate a contract farming negotiation with a classmate as the buyer • Record agreed price, quality and delivery terms • Prepare a contract compliance checklist for one contracted crop listing all quality and delivery requirements • Conduct research on one Nigerian outgrower scheme • Record the crop,	Guide students to: • Read and annotate a sample horticultural production contract • Identify five key clauses explaining each • Identify one contract farming opportunity for a college farm crop • Record the company, crop required and entry requirements • Simulate a contract farming negotiation with a classmate as the buyer • Record agreed price, quality and delivery terms • Prepare a contract compliance checklist for one contracted crop listing all quality and delivery requirements • Conduct research on one Nigerian outgrower scheme	Sample production contract, Contract clause guide, Negotiation role-play guide, Compliance checklist template, Outgrower scheme research guide.

	identification process 4.7 Describe aggregation systems for horticultural produce marketing in Nigeria.			company, terms and farmer benefits offered - Identify a horticultural aggregation model in Nigeria - Document its marketing advantages.	- Record the crop, company, terms and farmer benefits offered - Identify a horticultural aggregation model in Nigeria Document its marketing advantages.	
General Objective 5.0: Understand export marketing for Nigerian horticultural produce						
11 – 12	5.1 Describe Nigeria's horticultural export opportunities: sesame, ginger, plantain, fresh vegetables and dried fruits. 5.2 Outline documentation required for the export of fresh Nigerian horticultural produce. 5.3 Describe quality and	- Explain export opportunities with trade data for every crop - Describe export documentation with sample documents - Discuss quality and certification requirements, step by step - Explain buyers' identification channels; - Explain the roles of some export agency and ways to access their services	Nigerian export trade data, Sample export documents, Certification requirements guide, NEPC website, Alibaba platform, agency contact list, Projector.	- Conduct research on the export requirements for one Nigerian horticultural crop - Record destination market, standards and certification needed - Prepare a mock export documentation package: - Phytosanitary certificate, - Packing list - Invoice for one consignment - Identify potential export buyers using NEPC website or Alibaba - Record buyer name, location and product	Guide students to: - Conduct research on the export requirements for one Nigerian horticultural crop - Record destination market, standards and certification needed - Prepare a mock export documentation package: - Phytosanitary certificate, - Packing list - Invoice for one consignment - Identify potential export buyers using NEPC website or Alibaba	Export requirements research guide, Document templates, NEPC website, Compliance checklist template, FOB price calculation worksheet.

	certification requirements for export: Global G.A.P, NAFDAC and phytosanitary certificate. 5.4 Describe how to find export buyers: trade fairs, export promotion agencies and online B2B platforms. 5.5 Describe the role of export promotion agencies: NEPC, NAFDAC and NCS in horticultural export. 5.6 Describe traceability and product documentation requirements for export			requirement • Prepare a compliance checklist for exporting one crop to the EU market • Record all required standards • Calculate the FOB export price for one crop • Record farm gate price, processing, certification and shipping costs • Prepare a simple traceability record for a horticultural export consignment.	• Record buyer name, location and product requirement • Prepare a compliance checklist for exporting one crop to the EU market • Record all required standards • Calculate the FOB export price for one crop • Record farm gate price, processing, certification and shipping costs • Prepare a simple traceability record for a horticultural export consignment.	
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	horticultural markets.					
General Objective 6.0: Develop a digital agribusiness plan for a horticultural enterprise						
	6.1 Describe components of a digital agribusiness plan for a horticultural enterprise. 6.2 Explain how to integrate digital marketing and e-commerce into a horticultural business plan. 6.3 Describe the use of data and analytics to improve horticultural business decisions. 6.4 Explain pitching of horticultural agribusiness idea to an	• Explain digital agribusiness plan components with a sample plan • Describe integration of digital marketing and e-commerce into the plan • Explain use of sales data and analytics in business decisions • Explain a two-minute pitch for a horticultural agribusiness idea • Discuss some funding opportunities: NIRSAL, YouWin, AGSMEIS and donor grants	Sample digital agribusiness plan, digital marketing integration guide, analytics guide, pitch template, funding opportunities guide, projector.	• Prepare a digital agribusiness plan for one horticultural enterprise including production, digital marketing and financial projections • Develop a digital marketing strategy for the enterprise: specify platforms, content types, posting schedule and budget • Prepare a two-minute pitch for the enterprise • Practice and record key points on one page • Present the digital agribusiness plan to the class responding to at least two questions from the panel • Conduct research on one funding opportunity relevant to the enterprise	Guide students to: • Prepare a digital agribusiness plan for one horticultural enterprise including production, digital marketing and financial projections • Develop a digital marketing strategy for the enterprise: specify platforms, content types, posting schedule and budget • Prepare a two-minute pitch for the enterprise • Practice and record key points on one page • Present the digital agribusiness plan to the class responding to at least two questions from the panel • Conduct research on one funding opportunity relevant to the	Digital agribusiness plan template, Digital marketing strategy template, pitch preparation guide, Funding opportunities guide.

	investor or panel. 6.5 Describe government and donor funding opportunities for horticultural agribusiness in Nigeria. 6.6 Explain how data and market information support horticultural business decisions.		Record eligibility, amount and application process	enterprise Record eligibility, amount and application process											
COURSE ASSESSMENT: <table><tr><td>Course work:</td><td>10%</td></tr><tr><td>Test/Assignments:</td><td>10%</td></tr><tr><td>Practical:</td><td>40%</td></tr><tr><td>Examination:</td><td>40%</td></tr><tr><td>Total:</td><td>100%</td></tr></table>						Course work:	10%	Test/Assignments:	10%	Practical:	40%	Examination:	40%	Total:	100%
Course work:	10%														
Test/Assignments:	10%														
Practical:	40%														
Examination:	40%														
Total:	100%														

LIST OF MINIMUM EQUIPMENT

1.0 LABORATORIES

a) Entomology/Pest Control & Plant Pathology/Crop Protection

S/N	ITEM	QUANTITY REQUIRED
1.	Insect reference boxes	10
2.	Fly Nets/sweep net	15
3.	Magnify lens	10
4.	Graduated Tubes	5
5.	Cages	10
6.	Lamps	10
7.	Cool Boxes/cooler	5
8.	Batteries (PKS)	20
9.	Knapsack Sprayer	5
10.	ULV Sprayer	2
11.	Electrodyne Sprayer	2
12.	Handy Sprayer with container	5
13.	Refrigerator	1
14.	Store for samples	1
15.	Drying oven (Plants)	1
16.	Flood jet nozzle (1.5 TK)	3
17.	Hand gloves	10
18.	Biological pH meter	1
19.	Olympus monocular microscope	10
20.	Hand/Pocket lenses	10
21.	Scapels	10
22.	Steriliser	10
23.	Thistle Funnel	10

24.	Large Dessicators	5
25.	Small Dessicators	10
26.	Long Scissors	5
27.	Curved Scissors	5
28.	Nodule counter	1
29.	Nematode detector	1
30.	Microscope (simple/compound)	5
31.	Soil testing Outfit (pH kit)	5
32.	Water quality checker	1
33.	Long forceps	5
34.	Spatula knives	10
35.	Pen knives	10
36.	Thermometers	5
37.	Lux meter	2
38.	CO ₂ meter	2

b) Soil Science

S/N	ITEM	QUANTITY REQUIRED
1.	EC meter	1
2.	pH meter	2
3.	TDS meter	1
4.	Top loading balance	2
5.	Electric furnace	1
6.	Drying cabinet	1
7.	Flame photometer	1
8.	Electro spectrophotometer	1
9.	Calorimeter	1
10.	Vacuum pump	1
11.	Mircodigester for N	1
12.	Centrifuge	1

13.	Dessicator /Humidity content	1
14.	Autoclave	1
15.	Sieve Shaker (small)	1
16.	Deionises	1
17.	Fume hood	1
18.	Bottle shaker	1
19.	Water bath	1
20.	Hot plate	1
21.	Sand bath	1
22.	Drying oven (soils)	1
23.	Drying oven (plants)	1
24.	Astel incubator	1
25.	Ohans moisture balance	1
26.	Pye Unicorn series	1
27.	Atomic absorption spectrophotometer	1
28.	Analytical balance	2
29.	Soil capillarity determination apparatus	1
30.	Soil carbon determination apparatus	1
31.	Computer	1
32.	Internet	1

2.0 STUDIO

a) Audio Visual

S/N	ITEM	QUANTITY REQUIRED
1.	Computer	20
2.	Tablet	2
3.	Internet App.	1
4.	Projector	3
5.	Magnetic board	1
6.	Digital camera	1

7.	Public address system	1
8.	Video camera	1
9.	Smart board	1
10.	a) Microphone/stand	1
11.	b) Speakers	1
12.	c) Mega-phone	1
13.	Photo trimer	1
14.	Flood light	1
15.	Colour printer	1

b) Drawing Studio

S/N	ITEM	QUANTITY REQUIRED
1.	Drawing boards/stools	30
2.	Drafting set	10
3.	T-square	10
4.	Set square (ordinary)	10
5.	Protractors	10
6.	Leroy lettering sets	10
7.	Graphos pens	10
8.	Raphidographs (set of spent)	10
9.	Pencil sharpening machine	10
10.	Adjustable set squares	10
11.	Stanocinpt lettering sets	10
12.	Light tables	30
13.	Lettering stencils and templates	10
14.	Computer	10
15.	Smart board	1

3.0 HORTICULTURAL MACHINERY AND TOOLS

S/N	ITEM	QUANTITY REQUIRED
1.	Tractor	1
2.	Drone	1
3.	Disc plough	1
4.	Disc harrows	1
5.	Rotavaters	1
6.	Seed drill	1
7.	Seed cleaner	1
8.	Spike tooth harrow	1
9.	Rotary slasher	1
10.	Sub soiler	1
11.	Secateurs	10
12.	Hand shears/Hedge shears	10
13.	Hand trowels	10
14.	Hand forks	10
15.	Bulb planter	10
16.	Loppers	10
17.	Range cultivators	10
18.	Garden spades	10
19.	Boc knives	10
20.	Hand gloves	10
21.	Cutlasses	10
22.	Wheel barrow	5
23.	Head pan	5
24.	Garden lines	5
25.	Tapping knives	10
26.	Dutch hoes	10
27.	Lawn rakes	5
28.	Grabber rakes	5

29.	Diggers	5
30.	Pick axe	5
31.	Shovel	5
32.	Lawn mowers	1
	a) 3.5 HP	
	b).4.0 HP	
	c) 5.0 HP	
33.	Measuring tape	2
34.	Nursery Screen house and accessories	1
35.	Production screen house and accessories	1
36.	Growth chamber	1
37.	Digital scale	1

4.0 MAINTENANCE WORKSHOP

S/N	ITEM	QUANTITY REQUIRED
1.	Tool boxes	2
2.	Hydraulic jack	2
3.	Service pit	1
4.	Teaching models or scraps of:	
	a) Tractor engine	1
	b) Trailers	1
	c) Plough	1
	d) Harrows	1
	e) Rotavators	1

5.0 METEOROLOGICAL EQUIPMENT

S/N	ITEM	QUANTITY REQUIRED
1.	Stevenson's screen	1

2.	Thermo hygrographs	1
3.	Maximum and minimum thermometer	1
4.	Rain gauge	1
5.	Measuring glasses	1
6.	Wind vane	1
7.	Anemometer	1
8.	Evaporimeters	1
9.	Hygrometers	1
10.	Barometers	1
11.	Mobile App.	1
12.	Automated weather station	1
13.	LED grow light	1

6.0 NURSERY TOOLS/STORE

S/N	ITEM	QUANTITY REQUIRED
1.	Watering can	5
2.	Nursery trays	20
3.	Wheel barrow	2
4.	Seed sower	1
5.	Root pruner	1
6.	Plant lifter	1
7.	Flame weeder/hedger	1
8.	Secateurs	2
9.	Planting hoes	5
10.	Spade	2
11.	pick axe	2
12.	Hand trowel	5
13.	Head pans	2
14.	Machetes	5
15.	Cutting knives	5

16.	Germination boxes	10
17.	Drying tray	5
18.	Grafting bench	2
19.	Poly pots	10 packs
20.	Rooting hormones	5

7.0 SURVEY EQUIPMENT/STORE

S/N	ITEM	QUANTITY REQUIRED
1.	Stereoscope	1
2.	Prismatic compass	1
3.	Ranging poles	5
4.	Günter's Chain	2
5.	Metric tape	2
6.	Drawing board	5
7.	Protractors	5
8.	Planimeters	1
9.	Theodolite and staff	2
10.	Scale rulers	2
11.	Set square	5
12.	Set of arrows	5
13.	Levels	5
14.	T-square	5
15.	Pantograph	3
16.	GPS	2

8.0 IRRIGATION EQUIPMENT

S/N	ITEM	QUANTITY REQUIRED
1.	Sprinkler irrigation kit 2000	2
2.	Hoses	5
3.	Rotating sprinkler for 5 Hs.	1
4.	Big boss irrigation gun for 8 Ha.	1

5.	Current meter	2
6.	Electric motor water pump	1
7.	Pipes (Galvanised or PVC)	50
8.	Clips	50
9.	Fertigation system	1
10.	Storage tank	1

9.0 POST HARVEST TECHNOLOGY TOOL AND EQUIPMENT

S/N	ITEM	QUANTITY REQUIRED
1.	Specimens/Samples	10
2.	Worksheets	10
3.	Chart	10
4.	Reference Ethylene sensor (handheld)	1
5.	KMnO ₄ traps: ripening agents	1
6.	Digital scale	1
7.	Humidity chamber	1
8.	Evaporative cooler (clay pot)	2
9.	Prototype storage system	1
10.	PPE	5
11.	Calculator	2
12.	Container	10
13.	Crates	10
14.	Refrigerator	1
15.	Thatch grass	1
16.	Cooling chamber	1
17.	Prototype cold room	1
18.	Cold chain and accessories	1
19.	Spoiled produce samples	
20.	Petri dishes	10

21.	Packing materials	10
22.	Refractor meter	2
23.	HACCP template	2
24.	Printed guideline	2
25.	Specimen jars	5
26.	Dissections kits	2
27.	Data recording sheets	
28.	Simulated store area	
29.	MAP packaging materials	
30.	Slicers	2
31.	Pickling jar	10
32.	QR code reader	1
33.	Blanching basket	2
34.	Blender	1
35.	Juicer	1
36.	Cleaning tools	
37.	Shelving unit	1

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