

NATIONAL BOARD FOR TECHNICAL EDUCATION

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

HIGHER NATIONAL DIPLOMA

IN

ANIMAL PRODUCTION TECHNOLOGY

CURRICULUM AND COURSE SPECIFICATIONS

JUNE, 2026

PREFACE

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

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

Professor Idris M. Bugaje, FNSE
Chairman, Implementation Committee
EXECUTIVE SECRETARY
National Board for Technical Education (NBTE), Kaduna

ACKNOWLEDGEMENT

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

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

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GENERAL INFORMATION

1.0 TITLE OF THE PROGRAMME

Higher National Diploma (HND) Animal Production Technology

2.0 PROGRAMME GOAL

The Higher National Diploma in Animal Production Technology, is designed to produce technically competent and entrepreneurial diplomates in Animal Production Technology with requisite skills to effectively manage livestock enterprises and promote sustainable animal production practices.

3.0 OBJECTIVES OF THE PROGRAMME

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

i) Apply foundational scientific principles in Animal Production;
ii) Utilize Modern Techniques in Livestock Breeding and Management;
iii) Manage Forage Production and Animal Nutrition Systems;
iv) Operate Farm Machinery and Production Technologies;
v) Conduct Animal Husbandry Research and Data Analysis;
vi) Manage Livestock Enterprises and Agribusiness Operations;
vii) Implement Animal Health and Biosecurity Practices;
viii) Process Animal Products using Quality Standards;
ix) Promote Animal Welfare and Environmental Sustainability;
x) Communicate Animal Husbandry knowledge through Extension Services;
xi) Adhere to Professional and Regulatory standards;
xii) Use Digital Tools and Technologies in Livestock management;
xiii) Apply Good Animal Husbandry Practices and Food Safety Standards;
xiv) Demonstrate Entrepreneurial Skills for Self-employment in the Livestock Sector.

3.0 ENTRY REQUIREMENTS

The minimum entry requirements into the Higher National Diploma (HND) in Animal Production Technology
In addition to the O level requirements:

i) ND Animal Health and Production Technology, ND Agricultural Technology and other related programme (with Lower credit and above).
ii) Candidate with a Pass at ND Level with two (2) or more post ND cognate work experience may be considered for admission
iii) Must have undergone one-year mandatory industrial training in relevant institution/organization.

4.0 STRUCTURE/DURATION OF THE PROGRAMME

The HND Animal Production Technology is a terminal programme structured to last for two (2) years (four semesters) of classroom work, laboratory, field trip and workshop practices in relevant MDAs or Units.

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, tests and examinations.

5.0 CURRICULUM

The HND Animal Production Technology programme consists of four (4) main components. These are:

i) General studies/General education courses
ii) Foundation courses
iii) Professional courses
iv) Project work

7.0 STAFFING REQUIREMENTS:

7.1 Core Teaching Staff

A minimum of four (4) Core Lecturers who should be Lecturer II and above staff, with minimum qualification of HND or BSc in Animal Production Technology or Agricultural related disciplines. In addition, core lecturers should be registered members of relevant professional body.

7.2 Headship of the Department (HOD)

The Head of Department shall have at least Master's degree in Animal Science/Production Technology or related field. He or she shall not be less than the rank of a Senior Lecturer and must be registered with the relevant professional body and must have a minimum of twelve (12) years' experience in both academia and industry.

7.3 Technical Staff

There should be technical staff;

i) **Technologist**

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

ii) **Technician**

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

iii) **Farm Assistants**

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

7.4 Career/Academic Prospects

The diplomate who trained as Animal Production Technology professional can work in public and private sectors, including various tiers of Agricultural institutions, government parastatals, agencies like Ministry of Agriculture, Ministry of livestock, Ministry of Marine and Blue Economy.

8.0 CERTIFICATION

A diplomate of this programme shall be awarded HND Animal Production Technology

9.0 AWARD OF HIGHER NATIONAL DIPLOMA (HND)

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

i) Satisfactory performance in all prescribed course work/assignments, tests/quizzes, workshop practice, laboratory work, field trips, etc.;
ii) Satisfactory performance in all semester examinations;
iii) Satisfactory completion of written project/seminar papers;
iv) Candidate must have completed a minimum of 72 to 80 credit units

9.1 Conditions for the Award of HND:

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

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

9.2 Classification of Diplomas:

Diploma Certificates shall be awarded based on the following classifications:

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

10.0 ACCREDITATION OF PROGRAMME

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

11.0 LOGBOOK

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

12.0 FINAL YEAR PROJECTS

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

13.0 Guidance Notes for Teachers of the Programme:

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

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

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

13.4 The teaching of theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory. For each course, there should be a balance of theory to practice in the ratio of 20:80 respectively.

14.0GUIDELINES ON MANDATORY SKILLS QUALIFICATIONS (MSQ)

Please, see the Guidelines for the Implementation of MSQ in Polytechnics in Nigeria, available on NBTE website (web.nbte.gov.ng/downloads).

CURRICULUM TABLE

YEAR I SEMESTER I

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 301	Use of English III	2	0	0	2	2
2.	MSQ 311	Principles of Quality Assurance Assessment	1	0	1	2	2
3.	APT 311	Introduction to Biochemistry	1	0	3	4	4
4.	APT 312	Introduction to Microbiology	1	0	3	4	4
5.	APT 313	Forage Production and Conservation	1	0	3	4	4
6.	APT 314	Animal Farm Mechanization	1	0	3	4	4
7.	APT 315	Genetics and Animal Breeding	1	0	3	4	4
8.	APT 316	Animal Anatomy	1	0	2	3	3
9.	APT 317	Animal Physiology	2	0	2	4	4
10.	APT 318	Livestock Farm Practice I	1	0	3	4	4
TOTAL			**12**	**0**	**23**	**35**	**35**

YEAR I SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 302	Communication in English III	2	0	0	2	2
2.	ENT 326	Practice of Entrepreneurship I	2	0	2	4	4
3.	MSQ 321	Practice of Quality Assurance Assessment	1	0	1	2	2
4.	APT 321	Nutritional Biochemistry	1	0	2	3	3
5.	APT 322	Field Experimentation and Data Analysis for Livestock Value Chain	1	0	2	3	3
6.	APT 323	Livestock Farm Management	2	0	0	2	2
7.	APT 324	Livestock Farm Practice II	0	0	4	4	4
8.	APT 325	Animal Nutrition	1	0	2	3	3
9.	APT 326	Sheep and Goat Production	1	0	2	3	3
10.	APT 327	Mini-Livestock Production	1	0	2	3	3
11.	APT 328	Apiculture and Hive Products	1	0	2	3	3
12.	APT 329	Computer Application in Animal Production	1	0	2	3	3
TOTAL			**14**	**0**	**21**	**35**	**35**

YEAR II SEMESTER I

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 401	Communication in English IV	2	**0**	**0**	2	2
2.	ENT 416	Practice of Entrepreneurship II	2	0	2	4	4
3.	AGR 401	Research Methodology and Scientific Writing	1	0	1	2	2
4.	APT 411	Farm Animal Parasitology	1	0	3	4	4
5.	APT 412	Pasture and Range Management II	1	0	3	4	4
6.	APT 413	Poultry Production	1	0	3	4	4
7.	APT 414	Swine Production	1	0	3	4	4
8.	APT 415	Hides and Skin Production	1	0	3	4	4
9.	APT 416	Livestock Extension Methods	1	0	2	3	3
10.	APT 417	Beef Cattle Production	1	0	3	4	4
TOTAL			**12**	**0**	**23**	**35**	**35**

YEAR II SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	AFT 422	Fisheries Resource Management	1	0	3	4	4
2.	AED 424	Rural Sociology	2	0	0	2	2
3.	APT 421	Applied Animal Nutrition	1	0	3	4	4
4.	APT 422	Farm Animal Diseases	1	0	3	4	4
5.	APT 423	Animal Products Processing and Hygiene	1	0	3	4	4
6.	APT 424	Dairy Cattle Production	1	0	3	4	4
7.	APT 425	Ethical and Professional Practice	2	0	0	2	2
8.	APT 426	Livestock Financing	1	0	1	2	2
9.	APT 427	Project	0	0	4	4	4
TOTAL			**10**	**0**	**20**	**30**	**30**

YEAR I SEMESTER I

INTRODUCTION TO BIOCHEMISTRY

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL AND PRODUCTION TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO BIOCHEMISTRY	**COURSE CODE: APT 311**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: I SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
GOAL: This course is designed to equip students with knowledge and skills on principles of biochemistry as they apply to animal metabolism, nutrition, feed composition, product quality and health.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the molecular organisation of the living cell and its relevance to animal biology; 2.0 Understand the importance of water, pH and buffers in animal physiology; 3.0 Know the properties, sources and metabolism of carbohydrates; 4.0 Understand monosaccharides, disaccharides and polysaccharides; 5.0 Understand the nature, biological and industrial importance of lipids; 6.0 Know the structure, properties and functions of proteins; 7.0 Understand the classification and reactions of amino acids; 8.0 Understand the nature, classification and kinetics of enzymes; 9.0 Comprehend vitamins and minerals in animal nutrition; 10.0 Understand metabolic pathways relevant to animal production.		

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO BIOCHEMISTRY	**COURSE CODE: APT 311**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: I SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: This course is designed to equip students with knowledge and skills on principles of biochemistry as they apply to animal metabolism, nutrition, feed composition, product quality and health.		
GENERAL OBJECTIVE 1.0: Understand the molecular organisation of the living cell and its relevance to animal biology		

THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1-2	1.1 Describe cell organelles and their functions. 1.2 Explain centrifugation and cell fractionation. 1.3 Describe chemical composition of cells. 1.4 Explain cell membrane structure and function (fluid mosaic model). 1.5 Describe the ATP cycle as the energy currency in biological systems. 1.6 Outline the sum total of metabolism. 1.7 Relate cell composition to animal nutrition requirements (feed formulation principles).	• Explain cell organelles and their functions • Discuss centrifugation and cell fractionation • Describe chemical composition of cells: carbohydrates, proteins, lipids, nucleic acids • Explain cell membrane structure and function (fluid mosaic model) • Describe the ATP cycle as the energy currency in biological systems • Discuss the sum total of metabolism: catabolism and	Textbooks Charts Internet Projector White Board Marker	• Perform cell fractionation using centrifugation on homogenised animal tissue (liver/muscle) • Draw cell organelles from microscope slides	Guide students to: • Perform cell fractionation using centrifugation on homogenised animal tissue (liver/muscle) • Draw cell organelles from microscope slides	Centrifuge Animal tissue (liver) Homogeniser Microscope Prepared slides Dissecting set Glassware Animal tissue models

		anabolism of carbohydrates, lipids and proteins • Explain cell composition to animal nutrition requirements (feed formulation principles)				
General Objective 2.0: Understand the importance of water, pH and buffers in animal physiology						
3	2.1 Explain the properties of water that make it the medium of life. 2.2 Define pH, pOH, pKa, pKb and their effect on cellular activities. 2.3 List physiological buffer systems. 2.4 Explain how buffer systems maintain blood pH and rumen pH in livestock . 2.5 Describe the consequences of acidosis and alkalosis in cattle (rumen acidosis, milk fever).	• Outline water properties and physiological buffer systems. • Explain pH, pOH, pKa, pKb and their effect on cellular activities • Discuss physiological buffer systems: bicarbonate, phosphate, protein buffers in blood • Explain how buffer systems maintain blood pH and rumen pH in livestock • Discuss the consequences of acidosis and alkalosis in cattle (rumen acidosis, milk fever)	Textbooks Charts Internet Projector White Board Marker	• Measure pH of rumen fluid, blood serum, and urine samples. using a pH meter • Prepare buffer solutions at specified pH values. • Test their buffering capacity.	Guide students to: • Measure pH of rumen fluid, blood serum, and urine samples using a pH meter • Prepare buffer solutions at specified pH values • Test their buffering capacity	pH meter Rumen fluid Buffer tablets Glassware Indicator solutions Lovibond comparator
General Objective 3.0: Know the properties, sources and metabolism of carbohydrates						

4-5	3.1 Define carbohydrates as polyhydroxy aldehydes or ketones. 3.2 Explain the classification of carbohydrates 3.3 List common sources of carbohydrates in animal feeds: maize, cassava, sorghum, milo. 3.4 Describe the role of carbohydrates as energy source, structural components and precursors. 3.5 Outline glycolysis: key enzymes; ATP yield; relationship to anaerobic fermentation (lactic acid in muscle). 3.6 Describe the rumen fermentation of carbohydrates to volatile fatty acids (VFAs): acetic, propionic, butyric acids as energy sources in ruminants. 3.7 Explain the role of cellulose digestion in ruminants (rumen microorganisms) 3.8 Describe substrate-level phosphorylation and the significance of glucose	• Explain carbohydrate classification with feed ingredient examples. • Discuss the classification of Carbohydrates. • Outline glycolysis steps on board. • Discuss common sources of carbohydrates in animal feeds: maize, cassava, sorghum, milo • Explain the role of carbohydrates as energy source, structural components and precursors • Describe the rumen fermentation of carbohydrates to volatile fatty acids (VFAs): acetic, propionic, butyric acids as energy sources in ruminants • Explain the role of cellulose digestion in ruminants (rumen microorganisms) • Describe substrate-level phosphorylation and the significance of glucose as a metabolic	Textbooks Charts Internet Projector White Board Marker	• Carry out qualitative tests for carbohydrates in feed ingredients: Molisch test, Fehling's test, Benedict's test, iodine test for starch • Identify reducing and non-reducing sugars	Guide students to: • Carry out qualitative tests for carbohydrates in feed ingredients: Molisch test, Fehling's test, Benedict's test, iodine test for starch • Identify reducing and non-reducing sugars	Feed samples (maize, cassava, sugarcane) Fehling's reagents Benedict's reagent Iodine solution Water bath Glassware

	as a metabolic fuel.	fuel				
General Objective 4.0: Understand monosaccharides, disaccharides and polysaccharides						
6	4.1 Explain monosaccharides systematically by carbon number (trioses, pentoses, hexoses) 4.2 Explain stereoisomerism, D- and L-isomers, optical activity 4.3 Define glycosidic linkage and distinguish alpha and beta linkages 4.4 State sources and biological importance of disaccharides (lactose in milk, maltose in grain) 4.5 Describe polysaccharides 4.6 Explain the significance of glycogen as the storage form of glucose in liver and muscle (meat quality)	• Explain monosaccharides systematically by carbon number (trioses, pentoses, hexoses) • Discuss stereoisomerism, D- and L-isomers, optical activity • Describe glycosidic linkage and distinguish alpha and beta linkages • Discuss sources and biological importance of disaccharides (lactose in milk, maltose in grain) • Explain polysaccharides: starch, glycogen, cellulose, chitin — structure and biological roles • Describe the significance of glycogen as the storage form of glucose in liver and muscle (meat quality)	Textbooks Charts Internet Projector White Board Marker	•Measure optical activity in glucose solution using a polarimeter •Hydrolyse lactose with lactase •Test for reducing monosaccharides produced •Perform test to distinguish starch from glycogen by iodine test	Guide students to: •Measure optical activity in glucose solution using a polarimeter •Hydrolyse lactose with lactase •Test for reducing monosaccharides produced •Distinguish starch from glycogen by iodine test	Polarimeter Glucose solution Lactose solution Lactase enzyme Iodine solution Glassware Water bath

General Objective 5.0: Understand the nature, biological and industrial importance of lipids						
7-8	5.1 Define lipids 5.2 Describe the structure of fatty acids 5.3 List natural sources of fats in animal diets and products 5.4 Describe triglyceride structure, physical properties and hydrolysis (saponification) 5.5 Explain the role of essential fatty acids (omega-3, omega-6) in livestock health and product quality. 5.6 Describe phospholipids and their role in cell membranes. 5.7 Outline beta-oxidation as the pathway for fatty acid catabolism and energy production. 5.8 Explain fat deposition and carcass quality.	• Explain lipids; classify as simple (fats, oils, waxes) and complex (phospholipids, glycolipids, steroids) • Discuss the structure of fatty acids: saturated vs. unsaturated; even-numbered carbon chains • Explain natural sources of fats in animal diets and products: animal fat (tallow), fish oil, vegetable oils • Explain triglyceride structure, physical properties and hydrolysis (saponification); define saponification and iodine numbers • Explain the role of essential fatty acids (omega-3, omega-6) in livestock health and product quality • Discuss phospholipids and their role in cell membranes	Textbooks Charts Internet Projector White Board Marker	•Test for fats using the grease spot test and Sudan III stain •Carry out saponification of cooking oil •Compare with animal fat (tallow) •Perform test to compare solubility of saturated and unsaturated fats in different solvents	Guide students to: •Test for fats using the grease spot test and Sudan III stain •Carry out saponification of cooking oil •Compare with animal fat (tallow) •Compare solubility of saturated and unsaturated fats in different solvents	Vegetable oil Tallow Sudan III solution Ethanol NaOH Bunsen burner Glassware Water bath

		• Explain beta-oxidation as the pathway for fatty acid catabolism and energy production • Discuss fat deposition and carcass quality; role of lipids in milk fat composition (dairy cattle)				
General Objective 6.0: Know the structure, properties and functions of proteins						
9	6.1 Explain the classification proteins as globular or fibrous 6.2 Describe the role of proteins in living matter. 6.3 Define prosthetic group 6.4 Describe the peptide bond and primary structure of proteins. 6.5 Explain secondary (alpha-helix, beta-sheet), tertiary and quaternary structures. 6.6 Describe denaturation: causes, reversibility 6.7 Explain the importance of colostrum proteins (immunoglobulins) in neonatal livestock immunity.	• Explain the classification proteins as globular or fibrous; list natural sources in livestock production (blood meal, fishmeal, soybean) • Discuss the role of proteins in living matter: structural, transport, catalytic, regulatory, defence (antibodies in colostrum) • Explain prosthetic group; describe conjugated proteins: hemoproteins, glycoproteins, lipoproteins • Discuss the peptide bond and primary structure of proteins • Explain secondary	Textbooks Charts Internet Projector White Board Marker	• Identify proteins in feed and animal samples using Biuret and Millon's tests • Isolate albumin from egg white by size exclusion chromatography • Denature albumin by heat, acid and alkali; compare solubility	Guide students to: • Identify proteins in feed and animal samples using Biuret and Millon's tests • Isolate albumin from egg white by size exclusion chromatography • Denature albumin by heat, acid and alkali; compare solubility	Egg white Milk Blood meal sample Millon's reagent Biuret reagent Chromat. column Water bath HCl NaOH

		(alpha-helix, beta-sheet), tertiary and quaternary structures • Discuss denaturation: causes, reversibility; relate to feed processing (heat damage to protein quality) • Explain the importance of colostrum proteins (immunoglobulins) in neonatal livestock immunity				
General Objective 7.0: Understand the classification and reactions of amino acids						
10-11	7.1 Explain the classification of amino acids by chemical nature of side groups: non-polar, polar, basic, acidic. 7.2 Describe D- and L-isomers. 7.3 Explain amphoteric nature of amino acids 7.4 Describe ionisation of amino acids in solution. 7.5 List essential amino acids for livestock 7.6 Explain limiting amino acids in feed formulation and the concept of protein	• Explain the classification of amino acids by chemical nature of side groups: non-polar, polar, basic, acidic. • Describe D- and L-isomers • Explain that L-amino acids are the biologically active form • Explain amphoteric nature of amino acids; define isoelectric point (pI) • Describe ionisation of amino acids in	Textbooks Charts Internet Projector White Board Marker	• Carry out ninhydrin test on amino acid solutions and protein hydrolysates. • Determine solubility of proteins at and away from their isoelectric point.	Guide students to • Carry out ninhydrin test on amino acid solutions and protein hydrolysates • Determine solubility of proteins at and away from their isoelectric point	Ninhydrin reagent Amino acid solutions Glassware pH meter Water bath

	quality (biological value). 7.7 Describe peptide bond formation (condensation) and hydrolysis.	solution • Explain essential amino acids for livestock (lysine, methionine, threonine, tryptophan) and feed ingredients providing them • Explain limiting amino acids in feed formulation and the concept of protein quality (biological value) • Describe peptide bond formation (condensation) and hydrolysis				
General Objective 8.0: Understand the nature, classification and kinetics of enzymes						
12-13	8.1 Define enzymes as biological catalysts 8.2 Explain specificity, high catalytic rate and directive effect. 8.3 Explain the classification of enzymes 8.4 Explain cofactors, coenzymes and prosthetic groups 8.5 List mineral cofactors important in livestock (Zn, Cu, Fe, Mn). 8.6 Describe the active site	• Explain enzymes as biological catalysts • Discuss the classification of enzymes. • Describe cofactors, coenzymes and prosthetic groups; • State mineral cofactors are important in livestock (Zn, Cu, Fe, Mn). • Explain the active site and enzyme-substrate complex (lock and	Textbooks Charts Internet Projector White Board Marker	•Determine the effect of temperature (15, 25, 37, 55°C) and pH (4, 7, 9) on the rate of amylase activity using starch substrate •Plot enzyme activity vs. temperature and pH curves; identify optimum values	Guide students to: •Determine the effect of temperature (15, 25, 37, 55°C) and pH (4, 7, 9) on the rate of amylase activity using starch substrate •Plot enzyme activity vs. temperature and pH curves; identify optimum values	Amylase solution Starch substrate Iodine solution Water baths at 4 temps Buffer solutions pH meter Spectrophotometer

	and enzyme-substrate complex (lock and key; induced fit). 8.7 Explain Michaelis-Menten kinetics 8.8 Describe enzyme inhibition 8.9 Explain the effect of pH and temperature on enzyme activity 8.10 Describe digestive enzymes in livestock GIT.	key; induced fit). • Discuss Michaelis-Menten kinetics • Explain enzyme inhibition: competitive, non-competitive, allosteric; relate to mycotoxin inhibition of animal enzymes. • Describe the effect of pH and temperature on enzyme activity; relate to rumen pH and body temperature regulation • Explain digestive enzymes in livestock GIT				
General Objective 9.0: Comprehend vitamins and minerals in animal nutrition (Skill-Gap Module)						
14	9.1 Explain the classification of vitamins as fat-soluble (A, D, E, K) and water-soluble (B-complex, C) 9.2 Explain the functions, sources and deficiency diseases of each vitamin group in livestock 9.3 List major minerals (Ca, P, Mg, Na, K) and trace minerals (Fe, Zn, Cu, Se, I) required by farm animals	• Explain the classification of vitamins as fat-soluble (A, D, E, K) and water-soluble (B-complex, C) • Explain the functions, sources and deficiency diseases of each vitamin group in livestock • Explain major minerals (Ca, P, Mg, Na, K) and trace	Textbooks Charts Internet Projector White Board Marker	• Determine vitamin C (ascorbic acid) content in fresh • Stored feed samples by titration/colorimetric method • Compare vitamin content of fresh vs. heat-processed feed samples	Guide students to: • Determine vitamin C (ascorbic acid) content in fresh • Stored feed samples by titration/colorimetric method • Compare vitamin content of fresh vs. heat-processed feed samples	Ascorbic acid standard Burette Colorimeter Fresh and heat-treated feed Glassware

	9.4 Describe role of vitamin D and Ca/P balance in bone formation 9.5 Describe vitamin A deficiency effects on reproduction and immune function in livestock	minerals (Fe, Zn, Cu, Se, I) required by farm animals • Describe role of vitamin D and Ca/P balance in bone formation • Explain the role of vitamin E and selenium as antioxidants • Explain vitamin A deficiency effects on reproduction and immune function in livestock				
General Objective 10.0: Understand metabolic pathways relevant to animal production (Skill-Gap Module)						
15	10.1 Outline the citric acid (Krebs) cycle and its central role in aerobic energy production. 10.2 Explain oxidative phosphorylation and ATP synthesis (electron transport chain). 10.3 Explain gross and net energy values of carbohydrates, fats and proteins (9 kcal/g fat; 4 kcal/g CHO and protein). 10.4 Describe protein catabolism	• Explain the citric acid (Krebs) cycle and its central role in aerobic energy production • Explain oxidative phosphorylation and ATP synthesis (electron transport chain) • Explain gross and net energy values of carbohydrates, fats and proteins (9 kcal/g fat; 4 kcal/g CHO and protein) • Describe protein catabolism	Textbooks Charts Internet Projector White Board Marker	• Calculate metabolisable energy content of a given feed formulation using proximate analysis data • Interpret blood glucose, ketone and urea data from provided clinical chemistry results of livestock	Guide Students to: • Calculate metabolisable energy content of a given feed formulation using proximate analysis data • Interpret blood glucose, ketone and urea data from provided clinical chemistry results of livestock	Feed proximate analysis tables Scientific calculators Clinical chemistry result sheets Whiteboard for group work

	10.5 Explain interconversions among metabolic pathways. 10.6 Describe metabolic adaptations during peak lactation.	• Explain interconversions among metabolic pathways • Discuss metabolic adaptations during peak lactation				

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

INTRODUCTION TO MICROBIOLOGY

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO MICROBIOLOGY	**COURSE CODE: APT 312**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: 1 SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
GOAL: This course is designed to equip students with knowledge and skills of microbiological concepts as they apply to livestock health, disease management, animal products hygiene, feed fermentation, and farm biosecurity.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the history, scope and relevance of microbiology to animal production; 2.0 Know microscopic examination of micro-organisms and staining techniques; 3.0 Understand systematic microbiology with focus on livestock pathogens and zoonoses; 4.0 Understand growth of micro-organisms and applied fermentation; 5.0 Know isolation, cultivation and preservation of micro-organisms from agricultural samples; 6.0 Know methods of control of micro-organisms in animal production settings; 7.0 Understand microbiology of animal products and zoonoses.		

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO MICROBIOLOGY	COURSE CODE: APT 312	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: This course is designed to equip students with knowledge and skills of microbiological concepts as they apply to livestock health, disease management, animal products hygiene, feed fermentation, and farm biosecurity		
GENERAL OBJECTIVE 1.0: Know the history, scope and relevance of microbiology to animal production		

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1-2	1.1 Outline the history and scope of microbiology. 1.2 List early scientists and their contributions. 1.3 Explain the role of microbiology in animal production manure management. 1.4 Explain the differences between beneficial and harmful microorganisms in livestock systems.	• Explain the history and scope of microbiology • Discuss scientists and their contributions (Pasteur, Koch, Leeuwenhoek) • Discuss the role of microbiology in animal production: disease diagnosis, feed fermentation, hygiene, manure management • Explain the differences between beneficial and harmful microorganisms in livestock systems	Textbooks, Charts Whiteboard, Markers. Computer system Internet	• Examine a drop of pond water and cattle rumen fluid under the microscope. • Sketch micro-organisms observed.	Guide students to: • Examine a drop of pond water and cattle rumen fluid under the microscope; • Sketch micro-organisms observed	Light, microscopes, Microscope slides, Pond water, Rumen fluid, Cover slips.
General Objective 2.0: Know microscopic examination of micro-organisms and staining techniques						
3-4	2.1 Explain the principle of microscopy. 2.2 Describe types of microscopes.	• Describe how microscopes work. • Explain types of microscopes: light, dark-	Textbooks, Charts Whiteboard, Markers.	• Demonstrate Gram staining on mixed cultures • Classify organisms as	Guide students to: • Carryout Gram staining on mixed cultures	Gram staining kits Crystal violet Safranin

	2.3 Explain the application of each type of microscopes in livestock disease diagnosis. 2.4 Describe staining techniques.	field, phase-contrast, electron • Describe the application of each type of microscopes in livestock disease diagnosis • Explain Gram staining with reference to bacterial pathogens of animals (E. coli, Staphylococcus).	Computer system Internet	Gram-positive or Gram-negative	• Identify organisms as Gram-positive or Gram-negative	Iodine Microscope slides Bunsen burner
General Objective 3.0: Understand systematic microbiology with focus on livestock pathogens and zoonoses						
4-5	3.1 Explain characteristics of different microorganism groups with emphasis on species affecting. 3.2 Explain the morphological and biochemical basis for classifying micro-organisms. 3.3 Explain key pathogens of livestock. 3.4 Describe zoonotic microorganisms and their public health significance in animal production.	• Discuss characteristics of different microorganism groups with emphasis on species affecting livestock. • Explain the morphological and biochemical basis for classifying micro-organisms (shape, flagella, capsule, spore formation, biochemical tests) • Discuss the key pathogens of livestock • Explain zoonotic microorganisms and their public health significance in animal production	Textbooks, Charts Whiteboard, Markers. Computer system Internet	• Carry out catalase test, oxidase test and cultural characteristics to identify common livestock pathogens • Sketch prepared slides of Bacillus, Clostridium, Salmonella, and fungal species	Guide students to: • Carryout catalase test, oxidase test and cultural characteristics to identify common livestock pathogens • Sketch prepared slides of Bacillus, Clostridium, Salmonella, and fungal species	Prepared slides Culture plates Catalase/oxidase reagents Incubator Refrigerator
General Objective 4.0: Understand growth of micro-organisms and applied fermentation						

6-7	4.1 Explain nutritional requirements of micro-organisms. 4.2 Describe environmental factors affecting microbial growth. 4.3 Describe the microbial growth curve (lag, log, stationary, death phases) and its relevance to food spoilage and silage making. 4.4 Explain fermentation and its application in animal feed production (silage, hay, probiotics).	• Explain nutritional needs and growth phases using animal production examples (silage bacteria, milk spoilage organisms). • Describe environmental factors affecting microbial growth: temperature, pH, moisture, oxygen, nutrients • Describe the microbial growth curve (lag, log, stationary, death phases) and its relevance to food spoilage and silage making • Explain fermentation and its application in animal feed production (silage, hay, probiotics)	Textbooks, Charts Whiteboard, Markers. Computer system Internet	• Prepare microbial growth media. • Sterilise microbial growth media. • Inoculate microbial growth media. • Record growth on petri dishes at 24h, 48h and 72h. • Carry out laboratory test to relate microbial growth to silage quality and milk hygiene.	Guide students to: • Prepare, sterilise and inoculate microbial growth media. • Record growth on petri dishes at 24h, 48h and 72h. • Relate microbial growth to silage quality and milk hygiene.	Nutrient agar Petri dishes Inoculation loops Incubator Autoclave Tally counter
General Objective 5.0: Know isolation, cultivation and preservation of micro-organisms from agricultural samples						
8-9	5.1 List types of culture media and their uses in animal disease diagnosis. 5.2 Describe methods of isolating micro-organisms from animal samples. 5.3 Explain pure culture techniques. 5.4 Describe preservation methods. 5.5 Distinguish between	• Explain types of culture media (nutrient agar, blood agar, MacConkey agar, selective media) and their uses in animal disease diagnosis • Discuss methods of isolating micro-organisms from animal samples: milk, faeces, skin swabs, feed • Explain pure culture techniques: streak plate,	Textbooks, Charts Whiteboard, Markers. Computer system Internet	• Prepare pure culture from mixed culture using streak plate method. • Inoculate bacteria aerobically (incubator) and anaerobically (anaerobic jar). • Isolate organisms from animal faecal and milk samples.	Guide students to: • Prepare pure culture from mixed culture using streak plate method • Inoculate bacteria aerobically (incubator) and anaerobically (anaerobic jar) Isolate organisms from animal faecal and milk samples	Inoculation loops Petri dishes Animal faecal samples Milk samples Bunsen burner BSL-2 PPE

	aerobic and anaerobic cultivation.	pour plate • Describe preservation methods: refrigeration, glycerol stock, freeze-drying • Explain the differences between aerobic and anaerobic cultivation; relate to livestock gut and rumen organisms				
General Objective 6.0: Know methods of control of micro-organisms in animal production settings						
10-12	6.1 List reasons why micro-organisms must be controlled in animal production (disease prevention, product quality, food safety). 6.2 Define sterilization, disinfection, sanitization and antisepsis. 6.3 Describe physical methods: heat (autoclaving, pasteurisation, dry heat), UV radiation, filtration. 6.4 Describe chemical methods: phenolics, quaternary ammonium compounds, halogens, formaldehyde; relate to farm disinfection protocols.	• Explain the reasons why micro-organisms must be controlled in animal production (disease prevention, product quality, food safety) • Discuss sterilization, disinfection, sanitization and antisepsis • Describe physical methods: heat (autoclaving, pasteurisation, dry heat), UV radiation, filtration • Explain chemical methods: phenolics, quaternary ammonium compounds, halogens, formaldehyde; relate to farm disinfection protocols • Explain biosafety levels and biosecurity measures	Textbooks, Charts Whiteboard, Markers. Computer system Internet	• Apply safety precautions in microbiological work. • Sterilise laboratory objects using the autoclave and dry heat oven. • Carry out disc diffusion (Kirby-Bauer) antibiotic sensitivity test on a Gram-negative organism isolated from animal sample. • Demonstrate effectiveness of common farm disinfectants using zone of inhibition test.	Guide students to: • Apply safety precautions in microbiological work • Sterilise laboratory objects using the autoclave and dry heat oven • Carry out disc diffusion (Kirby-Bauer) antibiotic sensitivity test on a Gram-negative organism isolated from animal sample • Demonstrate effectiveness of common farm.	Autoclave Dry heat oven Petri dishes Antibiotic discs Microbial cultures Farm disinfectants Ruler for zone measurement

	6.5 Explain biosafety levels and biosecurity measures relevant to livestock farms. 6.6 Define antibiotic resistance and explain its importance in animal production and food chain.	relevant to livestock farms • Discuss antibiotic resistance and explain its importance in animal production and food chain				
General Objective 7.0: Understand microbiology of animal products and zoonoses						
13-15	7.1 Describe microbial spoilage of meat, milk and eggs. 7.2 Explain principles of milk pasteurisation, meat refrigeration and egg fumigation as microbiological controls. 7.3 Define zoonoses. 7.4 List major zoonotic diseases relevant to livestock farmers. 7.5 Explain routes of transmission and personal protective measures for zoonoses. 7.6 Describe microbiological quality standards for meat, milk and eggs.	• Describe microbial spoilage of meat, milk and eggs: causative organisms, conditions favouring spoilage • Explain principles of milk pasteurisation, meat refrigeration and egg fumigation as microbiological controls • Explain zoonoses • Discuss major zoonotic diseases relevant to livestock farmers: Brucellosis, Anthrax, Salmonellosis, Leptospirosis, Rabies, Ringworm • Explain routes of transmission and personal protective measures for zoonoses • Describe microbiological quality standards for	Textbooks NAFDAC/ WHO guidelines Charts on zoonotic disease transmission	• Carry out total plate count on a milk sample before and after pasteurization. • Interpret microbiological quality results against standard limits.	Guide students to: • Carry out total plate count on a milk sample before and after pasteurisation • Compare results with published standards and draw conclusions.	Raw and pasteurised milk Plate count agar Incubator Colony counter Pipettes

		meat, milk and eggs (total plate count, coliform count)				

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

FORAGE PRODUCTION AND CONSERVATION

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: FORAGE PRODUCTION AND CONSERVATION	**COURSE CODE: APT 313**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: I SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
GOAL: This course is designed to equip students with the knowledge and skills of forage production and conservation		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Comprehend major forage plants and or crops; 2.0 Know different classifications of forage legumes and grasses; 3.0 Understand the environmental factors that affect forage production.; 4.0 Know the factors affecting the nutrient composition of forages; 5.0 know different methods of forage conservation; 6.0 Understand the health hazards associated with feeding contaminated or ill conserved forages.		

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL AND PRODUCTION TECHNOLOGY		
COURSE TITLE: FORAGE PRODUCTION AND CONSERVATION	COURSE CODE: APT 313	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOURS/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: This course is designed to equip students with the knowledge and skills of forage production and conservation		
GENERAL OBJECTIVE 1.0: Comprehend major forage plants and or crops		

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1-3	1.1 Define forage crops and or plants. 1.2 Explain different forage categories. 1.3 Describe major compositions of forage plants.	• Explain forage crops and or plants • Discuss different forage categories • Discuss major compositions of forage plants	Textbooks Charts Internet Projector White Board Marker	• Identify forage plants mostly grasses and legumes in the environment. • Distinguish between forage legumes and grasses.	Guide students to: • Identify forage plants in the surrounding environment • Prepare herbarium of major forage plants.	Herbarium showing different forage plants
General Objective 2.0: Know different classifications of forage legumes and grasses						
4-6	2.1 Explain major characteristics features of forages. 2.2 Discuss botanical classifications of forage grasses and legumes. 2.3 Elucidate the role of forage legumes in tropical farming systems.	• Explain the morphological differences in common forage grasses and legumes • Discuss botanical classifications of forage • Explain the role of forage legumes in tropical farming systems	Textbooks Charts Internet Projector White Board Marker	• Identify major characteristic features of forages. • Carry out botanical classification of forage legumes and grasses. • Identify the roles of forage legumes in tropical farming systems. • Carry out a mini survey and	Guide students to • Identify major forage plants in the locality • Prepare a herbarium of major forage plants in the locality • Carry out a mini survey and classification of forage legumes	botanical identification guides, plant press for herbarium specimens, 70% alcohol for preservation of delicate samples,

				classification of forage legumes and grasses in the immediate environment.	and grasses in the immediate environment	clipboard, high resolution camera Measuring tapes, quadrats, field notebooks, GPS/Camera
General Objective 3.0: Understand the environmental factors that affect forage production						
7-9	3.1 Explain environmental factors that affect forage production. 3.2 Explain seasonal impact on forage production. 3.3 Explain the influence of urbanization and development on forage production.	• Discuss the environmental factors that influence forage production • Discuss the influence of soil fertility, pH, pests and diseases on forage production • Explain seasonal impact on forage production	Textbooks Charts Internet Projector White Board Marker	• Measure environmental factors that affect forage production • Identify seasonal impact on forage production • Carry out forage production	Guide students to • Enumerate the environmental factors that affect forage production • Identify the seasonal impact on forage production • Determine forage production	Dry matter calculation, Sampling frequency
General Objective 4.0: Know the factors affecting the nutrient composition of forages						
10-12	4.1 Explain factors that affect nutrient composition of forages. 4.2 Explain the indices for determining forage nutrient composition. 4.3 Discuss Forage Yield Determination.	• Explain the factors that affect nutrient composition of forages ○ Explain the indices for determining forage nutrient composition	Textbooks Charts Internet Projector White Board Marker	• Identify factors that affect nutrient composition of forages. • Identify the indices for determining forage nutrient composition	Guide students to • Identify factors that affect forage nutrient composition • Imbibe processes for determining forage nutrient	laboratory proximate analysis of forage samples, Fibre analysis, anti-

		• Explain the processes for forage nutrient determination			composition	nutrient determinations
General Objective 5.0: Know different methods of forage conservation						
13-14	5.1 Define forage conservation. 5.2 Explain different methods of forage conservation. 5.3 Explain the limitations to forage conservation.	• Explain forage conservation • Explain different methods of forage conservation • Explain the limitations to forage conservation	Textbooks Charts Internet Projector White Board Marker	• Identify the different methods of forage conservation. • Identify the limitations to forage conservation.	Guide students to • Identify different methods of forage conservation • Imbibe the limitations to forage conservation	Video clips Charts
General Objective 6.0: Understand the health hazards associated with feeding contaminated or ill conserved forages						
15	6.1 Explain health hazards associated with feeding badly prepared hay. 6.2 Explain the dangers of feeding contaminated silages to farm animals. 6.3 Describe how to contain with silage and hay contaminations in animal nutrition.	• Discuss health hazards associated with feeding badly prepared hay to farm animals • Discuss the challenges of feeding contaminated silages to farm animals • Explain ways to contain with feeding contaminated hay and silages to farm animals	Lecture note, PDF files, Textbook on forage conservation, smart board, Markers	• Identify the dangers of feeding hadly prepared hay and contaminated silages to farm animals. • Identify how to contain bad hay and silages to farm animals.	Guide students to • Identify health hazards associated with feeding contaminated silages and ill prepared hay to farm animals • Identify ways of containing with these bad feeding practice in farm animals	Video Clips
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% **Total: 100%**						

ANIMAL FARM MECHANIZATION

PROGRAMME: HIGHER NATIONAL DIPLOMA (HND) ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: ANIMAL FARM MECHANIZATION	**COURSE CODE: APT 314**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: I SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
GOAL: This course is designed to equip students with knowledge and practical skills in animal farm mechanization		

GENERAL OBJECTIVES: On completion of this course, the students should be able to:
1.0 Understand trends in animal farm mechanization in Nigeria;
2.0 Understand sources of farm power;
3.0 Understand the operation, management and maintenance of tractors and tractor implements used in animal farms;
4.0 Know the operation, management and maintenance of forage and fodder machinery for pasture establishment, harvesting and conservation;
5.0 Understand the operation, management and maintenance of feed milling and mixing machinery and small-scale feed mill design;
6.0 Know automated livestock housing and Precision Livestock Farming (PLF) technologies for commercial livestock production;
7.0 Comprehend the operation, management and maintenance of milking and dairy mechanization systems;
8.0 Know how to operate, manage and maintain manure-handling, biogas and waste-management systems;
9.0 Understand principles of machinery maintenance, occupational health and safety, economics and digital transformation.

PROGRAMME: HIGHER NATIONAL DIPLOMA (HND) ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: ANIMAL FARM MECHANIZATION	COURSE CODE: APT 314	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE	PRACTICAL: 3 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: This course is designed to equip students with knowledge and practical skills in animal farm mechanization		
GENERAL OBJECTIVE 1.0: Understand the scope, levels, importance, constraints and modern trends in animal farm mechanization in Nigeria.		

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1-2	1.1 Define farm mechanization, animal farm mechanization, automation and precision livestock farming. 1.2 Outline the history and evolution of farm mechanization globally and in Nigeria. 1.3 State the importance of mechanization in animal. production 1.4 Describe levels of	• Explain farm mechanization, animal farm mechanization, automation and precision livestock farming. • Outline the history and evolution of farm mechanization globally and in Nigeria. • State the importance of mechanization in	Whiteboard, markers, projector, charts reference textbooks Internet	• Identify all forms of mechanization in use. • Compare a manually-operated, semi-mechanized and fully-mechanized livestock unit (visits or photo case studies). • Conduct a survey of nearby farms to document their mechanization status. • Identify gaps and	Guide students to: • Identify all forms of mechanization in use. • Compare a manually-operated, semi-mechanized and fully-mechanized livestock unit (visits or photo case studies). • Conduct a survey of nearby farms to	Survey form, transport. Camera, recording sheets, PPE.

	mechanization. 1.5 Outline factors affecting choice of mechanization regulatory. 1.6 Describe the constraints of mechanization in Nigeria. 1.7 Outline the relationship between mechanization, animal welfare and One Health. 1.8 Describe modern trends.	animal production • Describe levels of mechanization. • Outline factors affecting choice of mechanization regulatory. • Describe the constraints of mechanization in Nigeria • Outline the relationship between mechanization, animal welfare and One Health • Describe modern trends		improvement opportunities.	document their mechanization status. • Identify and document gaps and improvement opportunities.	
GENERAL OBJECTIVE 2.0: Understand sources of farm power						
3-4	2.1 Describe sources of farm power. 2.2 Describe internal combustion engines (ICE). 2.3 Describe electric motors. 2.4 Describe alternative energy sources. 2.5 Describe energy efficiency, energy	• Describe sources of farm power. • Explain internal combustion engines. • Explain electric motors. • Explain alternative energy sources. • Explain energy	Whiteboard, markers, projector, charts reference textbooks Internet	• Identify components of a 4-stroke engine on a cutaway model (or via diagram). • Conduct routine engine maintenance — oil check, fuel-filter and air-filter cleaning. • Operate a small	Guide students to: • Identify components of a 4-stroke engine on a cutaway model (or via diagram). • Conduct routine engine maintenance — oil check, fuel-	Engine cutaway model. Small engine, oil, fuel. Electric motor, multimeter. Solar PV demo system. Biogas digester (or model). Energy-audit

	audits and energy management for livestock farms. 2.6 Describe electrical safety. 2.7 Describe fuel storage and handling.	efficiency • Explain electrical safety. • Discuss fuel storage.		engine. • Observe RPM and fuel consumption. • Identify components of a single-phase electric motor. • Demonstrate testing for continuity. • Test the functioning of a a solar PV installation on the institutional farm or a training facility. • Set up a basic biogas digester model (or examine existing). • Conduct an energy audit on the institutional farm — list all electrical loads and compute monthly consumption.	filter and air-filter cleaning. • Start and operate a small engine; observe RPM and fuel consumption. • Identify components of a single-phase electric motor; demonstrate testing for continuity. • Examine a solar PV installation on the institutional farm or via demonstration. • Set up a basic biogas digester model (or examine existing). Conduct an energy audit on the institutional farm — list all electrical loads and compute monthly consumption.	checklist, calculator, PPE.

GENERAL OBJECTIVE 3.0: Understand the operation, management and maintenance of tractors and tractor implements used in animal farms.						
5-6	3.1 Describe the tractor components. 3.2 Describe tractor selection for animal farms. 3.3 Describe tractor controls. 3.4 Describe operating principles. 3.5 Describe the hydraulic system. 3.6 Describe Power Take-Off (PTO) 3.7 Describe tractor implements relevant to livestock farms. 3.8 Describe loader-bucket and three-point-hitch attachments. 3.9 Describe tractor safety. 3.10 Outline tractor procurement.	• Describe the tractor components • Describe tractor selection for animal farms • Describe tractor controls • Describe operating principles • Describe the hydraulic system • Describe PTO (Power Take-Off) • Describe tractor implements relevant to livestock farms • Describe loader-bucket and three-point-hitch attachments. • Describe tractor safety • Outline tractor procurement	Whiteboard, markers, projector, charts reference textbooks Internet	• Identify tractor components on an actual tractor. • Conduct pre-operation tractor checks. • Operate the tractor under direct supervision • Attach an implement to the 3-point hitch. • Operate a simple PTO-driven implement (mower, chopper). • Demonstrate safe tractor operation. • Document a routine tractor maintenance log.	Guide students to: • Identify tractor components on an actual tractor • Conduct pre-operation tractor checks • Operate the tractor under direct supervision • Engage PTO and operate a simple PTO-driven implement (mower, chopper). • Attach an implement to the 3-point hitch • Demonstrate safe tractor operation Document a routine tractor maintenance log.	Tractor (50–80 HP). Implements (plough, harrow, mower, baler, chopper). PPE (helmet, ear protection, boots). Tractor manual, maintenance-log template. Slope test area.
GENERAL OBJECTIVE 4.0: Know the operation, management and maintenance of forage and fodder machinery for pasture establishment, harvesting and conservation						
7	4.1 Describe pasture or	• Describe forage	Whiteboard, markers,	• Operate a sickle-	Guide students to:	Mower, tedder/rake. Forage chopper, baler

	forage production machinery. 4.2 Describe forage harvesting machinery. 4.3 Describe baling machinery. 4.4 Describe forage conservation. 4.5 Describe pasture renovation machinery. 4.6 Describe forage storage machinery and structures. 4.7 Describe forage handling. 4.8 Outline mechanized smallholder forage solutions. 4.9 Describe seasonal mechanization planning.	production machinery. • Describe forage harvesting machinery. • Describe baling machinery. • Describe forage conservation. • Describe pasture renovation. • Describe irrigation. • Describe forage storage. • Describe forage handling. • Outline smallholder solutions. • Describe seasonal planning.	projector, charts reference textbooks Internet	bar or rotary mower under supervision. • Cut a sample plot. • Operate a tedder/rake to windrow cut grass. • Operate a small-engine forage chopper. • Produce chopped forage for silage. • Operate a round or square baler. • Produce sample bales. • Set up a small bunker silo or 25-kg silage bag with chopped grass and molasses. • Seal fermentation and observe it. • Conduct hay-making: cut, dry to <15% moisture, bale, store. • Examine pasture irrigation systems at the institutional farm. • Compute machinery requirements for a	• Operate mower. • Operate tedder/rake. • Operate forage chopper. • Operate baler. • Set up silo. • Conduct hay-making. • Examine irrigation. • Compute machinery requirements.	(round/square). Silage bags, molasses, bunker. Hay shed, moisture meter. Calculator, recording sheets, PPE.

				10-ha forage field.		
GENERAL OBJECTIVE 5.0: Understand the operation, management and maintenance of feed milling and mixing machinery and small-scale feed mill design.						
8	5.1 Describe principles of feed processing. 5.2 Describe feed milling machinery. 5.3 Describe feed mixing equipment. 5.4 Describe weighing equipment. 5.5 Describe pelleting equipment. 5.6 Describe storage equipment. 5.7 Describe ingredient handling. 5.8 Describe small-scale feed-mill design. 5.9 Describe feed-mill quality control. 5.10 Describe feed-mill biosecurity. 5.11 Describe modern feed-	• Describe principles of feed processing. • Describe feed milling machinery. • Describe feed mixing equipment. • Describe weighing equipment. • Describe pelleting equipment. • Describe storage equipment. • Describe ingredient handling. • Describe small-scale feed-mill design. • Describe feed-mill QC. • Describe feed-mill biosecurity. • Describe formulation software.	Whiteboard, markers, projector, charts reference textbooks Internet	• Operate a hammer mill. • Mill maize/wheat or groundnut cake. • Change screen size and observe particle size. • Operate a horizontal-ribbon mixer. • Conduct a sample mixing test using marker dye (CV calculation). • Operate a pellet mill (where available) to produce pellets from a mash. • Use a sieve set to determine particle-size distribution of milled grain. • Conduct a feed-sampling protocol on a freshly-mixed batch. • Sketch a small-scale feed-mill	Guide students to: • Operate hammer mill. • Operate ribbon mixer. • Operate pellet mill. • Use sieve set. • Conduct feed sampling. • Sketch feed-mill layout. • Compute machinery sizing. • Demonstrate formulation software.	Hammer mill, screen sizes (3, 4, 6 mm). Maize, wheat, groundnut cake, soya bean meal. Ribbon mixer, marker dye. Pellet mill (if available). Sieve set, scale, sample bags. Calculator, sketching paper. Computer with formulation-software demo, PPE.

	formulation software.			layout for a 1,000-bird poultry enterprise. • Compute machinery sizing for a 1-ton/hour feed mill. • Demonstrate formulation software (Allix3 or AFOS).		
GENERAL OBJECTIVE 6.0: Know automated livestock housing and Precision Livestock Farming (PLF) technologies.						
9	6.1 Describe components of mechanized livestock housing. 6.2 Describe automated feeding systems. 6.3 Describe automated wagering systems. 6.4 Describe egg collection. 6.5 Describe IoT and Precision Livestock Farming (PLF). 6.6 Describe farm-management	• Explain mechanized housing components. • Describe automated feeding. • Describe automated watering. • Explain egg collection. • Describe IoT and PLF. • Describe farm-management software. • Describe drones in livestock. • Discuss data flow. • Describe automation	Whiteboard, markers, projector, charts reference textbooks Internet	•Write an observation report on a mechanized poultry house to identify ventilation, lighting, feeders and drinkers. •Operate manual feeder and chain feeder and •Compare distribution accuracy. •Operate nipple drinker line. •Check pressure and flow. •Examine egg-collection conveyor and grader. •Set up a temperature/humidity sensor with smartphone app. •Apply RFID tags on 5 animals.	Guide students to: • Examine mechanized house. • Operate feeders. • Operate drinkers. • Examine egg collection. • Set up sensors. • Apply RFID and view data. • Demonstrate FMS software. • Design	Poultry house with mechanization. Feeders, drinkers. Egg conveyor, grader. Temperature/humidity sensors. RFID tags, reader, smartphone. FMS software demo. Sketching tools, PPE.

	software. 6.7 Describe drones for pasture monitoring, livestock counting and herd movement. 6.8 Describe data flow. 6.9 Describe automation economics.	economics.		• Scan RFID and view data on a dashboard. • Use a farm-management software (Farmonaut or similar). • Design a fully mechanized 1,000-bird layer house with sensors and automation as a group exercise.	mechanized house.	
GENERAL OBJECTIVE 7.0: Comprehend the operation, management and maintenance of milking and dairy mechanization systems.						
10-11	7.1 Describe principles of mechanical milking. 7.2 Describe the components of milking equipment. 7.3 Describe milking systems. 7.4 Describe pre-milking preparation. 7.5 Describe post-milking. 7.6 Describe milk-quality monitoring automated in-	• Explain principles of mechanical milking. • Explain the components of milking equipment. • Explain milking systems. • Discuss pre-milking preparation. • Explain post-milking. • Discuss milk-quality monitoring.	Whiteboard, markers, projector, charts reference textbooks Internet	• Examine a milking parlour and identify all components. • Operate a bucket-type milker on a cow under supervision. • Conduct pre-milking preparation — wash udder, dip teats, strip foremilk. • Demonstrate cleaning and sanitisation of a milking machine — circulation cleaning. • Conduct CMT on milk samples. • Examine a milk	Guide students to: • Examine milking parlour. • Operate bucket milker. • Conduct pre-milking prep. • Demonstrate cleaning. • Conduct CMT. • Examine cooling tank. • Demonstrate cream separator. • Compute yield and FCR.	Milking parlour or bucket milker. Cow, milk samples. Teat dip, paper towels. Cleaning detergents, sanitiser. CMT paddle, reagent. Bulk tank, cream separator. Calculator, PPE.

	line sensors. 7.7 Describe milk-handling mechanization packaging. 7.8 Describe cooling and storage. 7.9 Describe small-scale dairy mechanization.	• Explain milk-handling mechanization. • Explain cooling and storage. • Explain small-scale dairy mechanization.		cooling tank. • Check temperature. • Use a hand-operated cream separator (where available). • Compute milk yield and FCR for a sample dairy unit.		
GENERAL OBJECTIVE 8.0: Understand the operation, management and maintenance of manure handling, biogas and waste management systems.						
12-13	8.1 Describe livestock manure characteristics. 8.2 Describe collection systems. 8.3 Describe storage. 8.4 Describe treatment. 8.5 Describe application. 8.6 Describe environmental and welfare aspects. 8.7 Describe biogas systems for livestock farms. 8.8 Describe regulatory	• Explain livestock manure characteristics • Explain collection systems • Explain storage • Discuss treatment • Discuss application • Explain environmental and welfare aspects • Explain biogas systems for livestock	Charts. Projector, whiteboard, Reference textbooks, internet	• Examine the institutional farm's manure-handling system. • Identify gaps. • Demonstrate construction of a small composting windrow with manure and crop residues. • Turn compost weekly. • Monitor temperature. • Construct a small biogas digester (1–2 m^3). • Compute gas yield. • Operate a manure	Guide students to: • Examine manure system. • Demonstrate composting. • Examine/construct biogas digester. • Operate manure spreader. • Conduct manure-value calculation. • Develop manure-management plan. • Examine slurry storage.	Institutional farm manure pit. Manure, crop residues, water, compost thermometer. Biogas digester (or model), gas-measuring tools. Manure spreader. Calculator, fertiliser prices. Manure-management plan template, PPE.

	compliance. 8.9 Describe carcass disposal. 8.10 Describe wastewater management.	farms. • Explain regulatory compliance • Describe carcass disposal • Explain wastewater management treatment and recycling.		spreader (where available). • Apply to a sample plot. • Conduct a manure-value calculation to N, P, K content × prevailing fertiliser prices. • Develop a manure-management plan for the institutional farm. • Examine a slurry tank or lagoon. • Observe biosecurity and welfare aspects.		
GENERAL OBJECTIVE 9.0: Understand principles of machinery maintenance, occupational health and safety, economics and digital transformation.						
14-15	9.1 Explain maintenance principles. 9.2 Describe routine maintenance. 9.3 Describe troubleshooting 9.4 Describe maintenance log. 9.5 Describe OHS.	• Explain principles of farm machinery maintenance • Discuss routine maintenance • Discuss troubleshooting • Describe maintenance log and spare-parts inventory. • Explain	Charts. Projector, whiteboard, Reference textbooks, internet, video clips.	• Develop a comprehensive maintenance schedule for the institutional farm machinery (daily, weekly, monthly, seasonal, annual). • Conduct routine maintenance on a tractor, hammer mill, mower and milking machine.	• Guide students to: • Develop maintenance schedule. • Conduct routine maintenance. • Fix minor fault. • Compute tractor economics. • Conduct OHS audit. • Visit tractor-hire service.	Maintenance-schedule template. Tractor, hammer mill, mower, milking machine. Tools, lubricants, spares. Calculator, computer. OHS audit checklist, transport for visit. Business-plan template. Projector, presentation

	9.6 Describe regulatory framework. 9.7 Describe economics of mechanization. 9.8 Explain leasing/hiring. 9.9 Explain sustainability. 9.10 Explain digital transformation. 9.11 Describe entrepreneurship 9.12 Describe support institutions. 9.13 Describe future trends.	occupational health and safety on mechanized farms • Explain regulatory framework • Explain economics of mechanization • Explain equipment leasing/hiring • Discuss sustainability in mechanization • Describe digital transformation • Explain entrepreneurship in farm mechanization • Describe support institutions • Explain the future of farm mechanization in Nigeria		• Log findings. • Fix a minor fault identified on a piece of machinery (e.g., loose belt, dirty filter, low oil). • Compute economics of a tractor such as purchase price, depreciation, fuel/lubricant cost, repair cost, hire-out rate, break-even hours per year. • Conduct an OHS audit on the institutional farm's machinery zones. • Write a technical report on a visit a Tractor hiring company or a tractor hire-purchase service. • Develop an entrepreneurship business plan for a custom feed-mill or tractor-hire service.	• Develop business plan. • Conduct debate.	board, PPE.

Course Assessment:
Course work: 20%
Test/Assignments: 20%
Examination: 60%
Total: 100%

GENETICS AND ANIMAL BREEDING

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: GENETICS AND ANIMAL BREEDING	**COURSE CODE: APT 315**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: I SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
GOAL: This course is designed to equip students with knowledge and skills of the principles and applications of genetics to animal breeding.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the basic theory of cell; 2.0 Know the mitotic and meiotic cell division and gametogenesis; 3.0 Understand Mendel's theory of heredity; 4.0 Understand multiple alleles and sex -linked inheritance in farm animals; 5.0 Understand gene and chromosome action; 6.0 Understand genetic engineering and biotechnology; 7.0 Know the basic principles of population genetics; 8.0 Understand the importance of qualitative and quantitative genes in animal breeding; 9.0 Understand breeding methods and their importance in animal improvement; 10.0 Know types of selection and principles of their heritability and equipment to farm animals; 11.0 Know the application of modern genomic selection and reproductive-biotechnology systems**;** 12.0 Understand the role of artificial insemination in animal improvement.		

PROGRAMME: HIGHER NATIONAL DIPLOMA GENETICS AND ANIMAL BREEDING						
COURSE TITLE: GENETICS AND ANIMAL BREEDING		COURSE CODE: APT 315		CONTACT HOURs: 4 HOURS/WEEK		
		CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK		
YEAR: I SEMESTER: I		PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills of the principles and applications of genetics to animal breeding.						
GENERAL OBJECTIVE 1.0: Understand the basic theory of cell						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1-2	1.1 Define a cell. 1.2 Explain cell theory. 1.3 List the different types of cell. 1.4 Explain the difference between a plant and an animal cell. 1.5 List the various components of a cell. 1.6 Explain the importance of cells as the basic unit of life.	• Explain cell • Explain cell theory • Identify the different types of cell • Explain the difference between a plant and an animal cell • List the various components of a cell • Discuss the importance of cells as the basic unit of life	White board, markers lecture notes, charts and projector Computer system Internet	• Identify a mammalian cell. • Identify the features of the animal cell. • Label the animal cell.	Guide students to: • Identify a mammalian cell • Identify the features of the animal cell • Compare an animal with plant cell • Label the animal cell	Textbooks, Compound microscope, Projector and specimen Computer system Internet White board, markers
General Objective 2.0: Know the mitotic and meiotic cell division and gametogenesis						

3	2.1 Define mitosis. 2.2 Define meiosis. 2.3 Define gametogenesis.	• Explain the process of mitosis • Explain the process of meiosis • Explain the process of gametogenesis	White board, markers lecture notes, charts and projector Computer system Internet	• Identify various stages of mitosis (prophase, metaphase, anaphase and telophase), example in Whitefish blastula. • Demonstrate meiotic cell division (spermatogenesis) using Grasshopper testes.	Guide students to: • Identify various stages of mitosis (prophase, metaphase, anaphase and telophase), example in Whitefish blastula • Demonstrate meiotic cell division (spermatogenesis) using Grasshopper testes	Light compound microscope Digital cameras, software and video players for presentation of mitosis and meiosis image sets Whiteboard Markers Computer system Internet
General Objective 3.0: Understand Mendel's theory of heredity						
4	3.1 Define Mendelian Theory. 3.2 Define heredity. 3.3 Define variation. 3.4 Explain the differences between heredity and variation.	• Explain core principles of Mendelian inheritance • Explain Mendel's single trait inheritance and the monohybrid ratio • Explain Mendel's double traits inheritance and the dihybrid ratio	Lecture notes, White board/markers and Charts Computer system Internet			
General Objective 4.0: Understand multiple alleles and sex-linked inheritance in farm animals						
	4.1 Define an allele. 4.2 Define multiple alleles. 4.3 Define sex-linked	• Explain deviations from Mendelian inheritance • Explain gene actions and interactions	White boards/markers and lecture notes			

	characters	• Explain alleles and multiple alleles • Explain sex-linked characters	Textbooks Computer System Internet			
General Objective 5.0: Understand gene and chromosome action						
5	5.1 Define a gene. 5.2 Explain the types of genes. 5.3 Define a chromosome. 5.4 Define DNA and RNA.	• Explain the nature and attributes of a gene • Discuss the types of genes • Explain the chromosome number in farm animals • Explain the role and importance of Deoxyribonucleic Acid (DNA) in animal breeding	White board/marker and lecture notes etc			
General Objective 6.0: Understand genetic engineering and biotechnology						
6	6.1 Define genetic engineering. 6.2 Define biotechnology. 6.3 Define recombinant DNA (rDNA) technology.	• Explain genetic engineering • Explain biotechnology • Explain recombinant DNA (rDNA) technology	White board/ markers, lecture notes and projectors Computer Internet			
General Objective 7.0 Know the basic principles of population genetics						
7	7.1 Define population genetics. 7.2 Describe the scope of population genetics. 7.3 Describe the Hardy-Weinberg principle.	• Explain the field of population genetics • Discuss the scope of population genetics • Explain the Hardy-Weinberg principle	White board/markers, lecture notes and projector			
General Objective 8.0 Understand the importance of qualitative and quantitative genes in animal breeding						

8-9	8.1 Describe qualitative traits in farm animals. 8.2 Describe quantitative traits in farm animals. 8.3 State the importance of qualitative and quantitative traits in animal breeding.	• Explain qualitative traits in farm animals • Explain quantitative traits in farm animals • Discuss the importance of qualitative and quantitative traits in farm animal	White board / markers, lecture notes and projector	• Identify qualitative traits in farm animals • Identify quantitative traits in farm animals • Use electronic microscopes to distinguish between qualitative and quantitative traits in farm animals.	Guide students to: • Identify qualitative traits in farm animals • Identify quantitative traits in farm animals • Distinguish between qualitative and quantitative traits in farm animals using electronic microscope	Textbooks, lecture notes computer system, internet and projector Electronic microscope
General Objective 9.0 Understand breeding methods and their importance in animal improvement						
10-11	9.1 Define breeding methods. 9.2 Describe types of breeding methods. 9.3 Describe the importance of breeding methods in animal improvement.	• Explain inbreeding methods • Explain outbreeding method • Discuss the importance of breeding methods in animal improvement	White board, lecture notes, computer system, and projector Computer system Internet Markers	• Carry out inbreeding methods (sibling mating, line breeding). • Demonstrate outbreeding methods (eg species crossing, breed crossing or crossbreeding) in animal breeding.	Guide students to: • Carry out inbreeding methods (sibling mating, line breeding) • Demonstrate outbreeding methods (eg species crossing, breed crossing or crossbreeding) in animal breeding • Discuss the differences between inbreeding and outbreeding	Textbooks, lecture notes, internet and projector
General Objective 10.0 Know types of selection and principles of their heritability in farm animals						
12-13	10.1 Define selection in animal breeding. 10.2 State the purpose of	• Explain selection and its importance • Discuss the purpose and	White board markers, lecture notes,	• Identify farm animal traits for selection. • Compute single trait	Guide students to: • Identify farm animal traits for selection	Textbooks, projector, internet

	selection. 10.3 State the types of selection. 10.4 State common selection traits. 10.5 State the factors that affect response to selection. 10.6 Define heritability. 10.7 State types of heritability. 10.8 List the factors affecting heritability in farm animals.	types of selection • Discuss common selection traits in farm animals and poultry • Discuss factors affecting response to selection • Discuss single trait selection and factors affecting their response • Discuss multi-traits selection and factors affecting their selection	charts and projectors	selection. • Carry out computation of multi-traits selection. • Compute broad and narrow sense heritability.	• Practice computation of single trait selection • Carry out computation of multi-traits selection • Practice computation of broad and narrow sense heritability	facility
General Objective 11.0 Know the a**pplication of modern genomic selection and reproductive-biotechnology systems**						
13-14	11.1 Define genomic selection and the difference between conventional EBV and Genomic Breeding Values (GEBV). 11.2 Explain Single Nucleotide Polymorphisms (SNPs), SNP-chip genotyping. 11.3 Describe Marker-Assisted Selection (MAS) applications. 11.4 Outline the	• Define genomic selection and GEBV. • Explain SNP-chip genotyping. • Describe MAS applications. • Outline genomic-prediction workflow. • Discuss Nigerian conservation genomics. • Describe sexed-semen technology. • Outline ET workflow. • Describe IVF/OPU workflows. • Discuss CRISPR case studies.	Genomic selection diagrams. • Illumina BovineHD/GeneSeek GGP information, MAS case studies, NACGRAB/ ARCN/NAPRI publication, Sexed-semen	• Identify SNP-chip information sheets and sample reports. • Interpret a sample GEBV report. • Run a simple genomic-prediction exercise in Excel (using sample data). • Identify sexed-semen straws and explain pricing/availability in Nigerian market. • View ET and IVF videos and complete comprehension	Guide students to: • Identify SNP-chip information sheets and sample reports. • Interpret a sample GEBV report. • Run a simple genomic-prediction exercise in Excel (using sample data). Identify sexed-semen straws and explain pricing/availability in Nigerian market. • View ET and IVF videos and complete	SNP-chip information sheets, Sample GEBV reports, Computer with Excel and genomic-prediction template, Sexed-semen sample straws, ET/IVF

	genomic-prediction workflow. 11.5 Discuss Nigerian context. 11.6 Describe sexed-semen technology. 11.7 Outline Embryo Transfer (ET) workflow. 11.8 Describe in vitro fertilisation (IVF) and Ovum Pick-Up (OPU) workflows. 11.9 Discuss CRISPR/Cas9 gene editing in livestock. 11.10 Outline ethical and regulatory considerations.	• • Outline ethical/regulatory considerations	sample straws, ET workflow video, IVF/OPU procedure videos, CRISPR case-study materials, Nigerian biosafety framework document	exercise. • Compose a term or discussion paper on ethical considerations of CRISPR in Nigerian livestock.	comprehension exercise. • Compose a discussion paper on ethical considerations of CRISPR in Nigerian livestock.	demonstration videos, Discussion paper templates
General Objective 12.0 Understand the role of artificial insemination in animal improvement						
15	12.1 Define artificial insemination (AI) in farm animal. 12.2 Explain types of artificial insemination in farm animals and poultry. 12.3 State the importance of artificial	• Discuss artificial insemination principles in farm animals and poultry • Discuss the types of artificial insemination in farm animal improvement • Discuss the step-by-step procedure of artificial	Textbooks, lecture notes, image sets, charts and projector Computer Internet Whiteboard Marker	• Carry out AI in different farm animals and poultry by following step by step procedures. • Demonstrate steps in applying AI procedures in notable farm animals and poultry.	Guide students to: • Carry out step by step procedures for application of AI in different farm animals and poultry • Demonstrate steps in applying AI procedures in notable farm animals and	Textbooks, lecture notes, internet facility, projector

	insemination in animal improvement.	insemination application and poultry			poultry	

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

ANIMAL ANATOMY

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: ANIMAL ANATOMY	**COURSE CODE: APT 316**	**CONTACT HOURS: 3 HOURS/WEEK**
	CREDIT UNIT: 3	**THEORETICAL: 1 HOUR/WEEK**
YEAR: I SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL: 2 HOURS/WEEK**
GOAL: This course is designed to equip students with practical knowledge and skills in the identification, examination, handling, drawing, labeling, and comparative study of the anatomical structures of farm animals.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the topographical and other descriptive terms used in Anatomy; 2.0 Understand the structure of the cutaneous Systems of farm animals; 3.0 Understand the structure of bone and cartilage as the basic materials of the Skeleton; 4.0 Understand the structure of the muscles and Joints of farm animals; 5.0 Know the structure of the digestive system of farm animals; 6.0 Understand the structure of the Respiratory system; 7.0 Know the structure and composition of the Circulatory System; 8.0 Understand the structure of the Urinary system; 9.0 Know the structure of male and female genitalia; 10.0 Know the structure of the Central Nervous System.		

PROGRAMME: HIGHER NATIONAL DIPLOMA Animal and Production Technology		
COURSE TITLE: ANIMAL ANATOMY	COURSE CODE: APT 316	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
Year: I Semester: I	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: This course is designed to equip students with practical knowledge and skills in the identification, examination, handling, drawing, labeling, and comparative study of the anatomical structures of farm animals.		
GENERAL OBJECTIVE 1.0: Know the Topographical and other Descriptive Terms Used in Anatomy		

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1-2	1.1 Define anatomy and its branches. 1.2 List the principal methods of studying anatomy. 1.3 Define descriptive terms such as cranial, caudal, dorsal, ventral, medial, lateral, proximal, distal and plantar. 1.4 Explain the importance of anatomical terms in describing farm animals.	• Explain anatomy and its branches • Discuss systematic and topographic methods of studying anatomy. • Describe descriptive terms such as cranial, caudal, dorsal, ventral, medial, lateral, proximal, distal and plantar.	White board, markers lecture notes, charts and projector Computer system Internet	• Locate descriptive anatomical landmarks on animal models or charts. • Demonstrate directional terms using animal specimens or models. • Draw simple diagrams showing anatomical directions. • Use correct anatomical terms to describe	Guide students to: • Identify anatomical regions on models and live animals. • Demonstrate anatomical directions practically. • Draw simple diagrams showing anatomical directions • Use correct anatomical terms to describe body regions..	Live animals Animal models Charts and diagrams Drawing materials

		• Discuss the importance of anatomical terms in describing farm animals.		body regions.		
GENERAL OBJECTIVE 2.0: Understand the structure of the Cutaneous Systems of Farm Animals						
3	2.1 Describe the structure of the integument and its appendages such as skin, hoof, hair and feathers. 2.2 Describe pictures or preserved samples of integumentary structures. List different types of feathers.	• Explain the structure of the integumentary system • Describe pictures or preserved samples of integumentary structures. Explain the component of integumentary system.	White board, markers lecture notes, charts and projector Computer system Internet	• Draw skin, hoof and feather. • Identify skin layers and appendages from specimens. • Identify and draw different types of feathers in poultry. Draw skin appendages among selected farm animals.	Guide students to: • Draw skin, hoof and feather. • Identify skin layers and appendages from specimens. • Identify different types of feathers in poultry. Draw skin appendages among selected farm animals.	Skin Hooves Feathers Charts Drawing materials Logbooks
GENERAL OBJECTIVE 3.0: Understand the Structure of bone and Cartilage as the basic materials of the Skeleton						
4-5	3.1 Classify bones according to gross appearance and function such as long, short, flat and irregular bones. 3.2 List the axial skeleton and its constituents such as skull, vertebrae, ribs and sternum. 3.3 List the composition appendicular skeleton made up of bones of the pectoral and pelvic limbs.	• Explain classification of bones and cartilages. • Describe axial and appendicular skeleton. • Discuss major bones of farm animals. • Discuss the	White board, markers lecture notes, charts and projector Computer system Internet	• Identify types of bones from farm animal skeletons. • Identify bones of the skull, vertebral column, ribs, sternum, pectoral limb and pelvic limb. • Draw different	Guide students to; • Identify types of bones from farm animal skeletons. • Identify bones of the skull, vertebral column, ribs, sternum, pectoral limb and pelvic limb • Draw different	Skeletal specimens Animal skeleton models Loose bones Drawing materials Logbooks Laboratory

		composition of appendicular skeleton.		views of selected bones. • Assemble selected skeletal parts correctly. Draw different views of bones in a skeletal system	views of selected bones. • Assemble selected skeletal parts correctly. Draw different views of bones in a skeletal system	
GENERAL OBJECTIVE 4.0: Understand the structure of muscles and joints of farm animals						
6	4.1 Describe the major types of muscles. 4.2 List the major muscles of different body regions such as face, neck, thorax, abdomen, limbs and tail. 4.3 Explain the structure of skeletal muscle including A band, I band, M line, Z line and H zone. 4.4 List the major joints in the body of farm animals.	• Explain muscle types and their locations. • Explain the skeletal structure. • Discuss and locate types of joints. • Discuss the type and location of joint in farm animals.	White board, markers lecture notes, charts and projector Computer system Internet	• Identify major muscles on models or specimens. • Draw gross and fine structure of skeletal muscle. • Indicate the I and A band, M and Z line and H-zone. • Identify major joints in farm animals. • Demonstrate movement of selected joints.	Guide student to: • Identify major muscles on models or specimens • Draw gross and fine structure of skeletal muscle. • Indicate the I and A band, M and Z. • Identify major joints in farm animals. • Demonstrate movement of selected joints.	Muscle specimens Joint models Charts Anatomy lab Live animals where available Drawing materials
GENERAL OBJECTIVE 5.0: Know the structure of the digestive system of farm animals						
7-8	5.1 List organs and parts of the mammalian digestive system such as mouth, teeth, tongue, esophagus, stomach and intestines. 5.2 List accessory digestive	• Explain digestive system of farm animals • Discuss ruminant,	Digestive tract charts and models; Animal skulls and teeth for identification;	• Identify organs of the digestive tract from specimens. • Identify ruminant,	Guide student to; • Conduct practicals on digestive tract identification. • Compare	Digestive tract specimens Animal farm Animal skulls and teeth

	organs such as liver, pancreas, spleen and gall bladder. 5.3 Explain dental formulae of different farm animals. 5.4 Differentiate ruminant, monogastric and avian digestive tracts. 5.5 Explain age estimation using teeth eruption.	monogastric and avian digestive systems. • Describe dental formulae and teeth eruption patterns. • Differentiate ruminant, monogastric and avian digestive tracts. • Explain age estimation using teeth eruption.	Lecture notes Textbooks Whiteboard and markers for illustrations. Project illustrative videos, Internet	monogastric and avian digestive tracts practically. • Draw digestive system of a named farm animal. • Estimate age of farm animals using teeth eruption and wear.	digestive systems of selected farm animals. • Draw digestive system of a named farm animal. • Estimate age of farm animals using teeth eruption and wear.	Models Dissecting kits PPE Drawing materials Logbooks
GENERAL OBJECTIVE 6.0: Understand the structure of the respiratory system						
9	6.1 Define respiratory system. 6.2 List the part of respiratory system and its composition. 6.3 List the organs and parts of the respiratory system. 6.4 Describe the structure of the respiratory organs. 6.5 Explain the importance of the respiratory system in farm animals. 6.6 Relate respiratory structures to their functions.	• Explain respiratory system and its composition • Describe the respiratory the parts of respiratory system. • Discuss the structure and arrangement of the nose, trachea and lungs. • Discuss the	White board, markers lecture notes, charts and projector Computer system Internet	• Identify respiratory organs from specimens. • Draw organs of the respiratory system. • Examine the trachea and lungs of farm animals.	Guide the students to: • Demonstrate respiratory organ identification • Compare respiratory organs with other structures • Participate in specimen examination. • Participate in tagging respiratory organs in the	Preserved lungs and trachea specimens Respiratory tract models and charts Dissecting trays Drawing materials, Specimen from abattoir Abattoir

		importance of the respiratory system in farm animals. .			abattoir or laboratory	
GENERAL OBJECTIVE 7.0: Know the structure and composition of the circulatory system						
10-11	7.1 List structures that make up the circulatory system such as heart, pulmonary artery, pulmonary vein and aorta. 7.2 Explain the structures identified in the circulatory system. 7.3 Explain the structure of the heart as the pumping organ.	• Discuss the main component of circulatory system • Discuss heart chambers and major blood vessels. • Describe blood flow through the heart.	White board, markers lecture notes, charts and projector Computer system Internet	• Identify the heart, major blood vessels and chambers. • Draw the heart. • Examine preserved heart specimens. • Trace the direction of blood flow through the heart using drawing.	Guide the students to: • Conduct practicals on heart and blood vessel identification • Examine preserved specimens. • Demonstrate blood flow in the specimen	Preserved heart specimens Heart models Charts Drawing materials Logbooks Abattoir
GENERAL OBJECTIVE 8.0: Understand the structure of the urinary system						
12-13	8.1 List organs that make up the urinary system. 8.2 Explain the gross structure of the kidney. 8.3 Explain the fine structure of the kidney. 8.4 Explain the relationship between urinary structures and excretion. 8.5 List the part of the structural unit of urinary system.	• Explain urinary system and the organs involved • Discuss gross and fine structure of the kidney Explain the urinary pathway. • Describe the structural unit of	White board, markers lecture notes, charts and projector Computer system Internet	• Identify urinary organs in specimens or models. • Draw gross and fine structure of the kidney. • Examine kidney specimens. • Trace urine pathway from kidney to	Guide the student to; • Demonstrate identification of urinary organs. kidney examination. • Supervise drawing and labeling of kidney structures. Grade drawings	Kidney specimens Urinary system models Dissecting kits Charts Drawing materials Logbooks Specimen

		urinary system and its components		urethra.	and practical reports.	from abattoir
GENERAL OBJECTIVE 9.0: Know the structure of male and female genitalia						
14	9.1 List the structures of the male genitalia such as scrotum, testis, vas deferens, spermatic cord and epididymis. 9.2 List the organs of the male genitalia. 9.3 List accessory sex organs such as seminal vesicles and prostate gland. 9.4 List structures of the female genitalia such as ovary, oviduct, uterus, cervix and vulva. 9.5 Describe organs of the female genitalia.	• Explain male and female reproductive organs • Describe the organs of male genitalia • Describe the accessory sex organs • Describe the structures of female genitalia • Describe organs of the female genitalia.	White board, markers lecture notes, charts and projector Computer system Internet	• Identify male reproductive organs from specimens or models. • Identify female reproductive organs from specimens or models. • Draw male genitalia of a named farm animal. • Draw and label female genitalia of a named farm animal. • Use anatomical models to differentiate male and female reproductive organs practically.	Guide student to; • Identify male reproductive organs from specimens or models. • Identify female reproductive organs from specimens or models. • Draw male genitalia of a named farm animal. • Draw female genitalia of a named farm animal. • Differentiate male and female reproductive organs practically.	Male and female reproductive specimens Dissection kits Specimen from abattoir
GENERAL OBJECTIVE 10.0: Know the structure of the Central Nervous System						
15	10.1 List the component of central nervous system. 10.2 List the parts of the central	• List the component of central nervous	White board, markers lecture notes, charts and	• Identify parts of the brain and spinal cord on	Guide student to; • Demonstrate identification of	Brain charts Spinal cord models

	nervous system. 10.3 Discuss the brain and spinal cord. 10.4 Describe the major parts of the brain and spinal cord. 10.5 Describe the central nervous system in body coordination. 10.6 Relate nervous structures to coordination and control.	system. • List the parts of the central nervous system. Identify the brain and spinal cord. • Describe the major parts of the brain and spinal cord. • Describe the central nervous system in body coordination.	projector Computer system Internet	models or specimens. • Draw the central nervous system. Examine preserved nervous tissue specimens where available.	brain and spinal cord structures. • Identify preserved specimen during practical examination and drawing.	Preserved specimens Charts Drawing materials Logbooks Specimen from abattoir
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% **Total: 100%**						

ANIMAL PHYSIOLOGY

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: ANIMAL PHYSIOLOGY	**COURSE CODE: APT 317**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 2 HOURS/WEEK**
YEAR: I SEMESTER: 1	**PRE-REQUISITE:**	**PRACTICAL: 2 HOURS/WEEK**
GOAL: This course is designed to equip students with knowledge and skills in the physiology of farm and companion animals		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: **1.**0 Understand the scope of animal physiology; 2.0 Know body fluids, blood, hemopoiesis, hemostasis, blood groups, immunity and the lymphatic system; 3.0 Comprehend cardiovascular physiology; 4.0 Understand respiratory physiology; 5.0 Understand comparative digestive physiology; 6.0 Understand excretory and urinary physiology, kidney function, fluid-electrolyte regulation and thermoregulation; 7.0 Know endocrine physiology; 8.0 Understand reproductive physiology and lactation; 9.0 Understand neurophysiology, muscle physiology and stress physiology in production animals**.**		

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY					
COURSE TITLE: ANIMAL PHYSIOLOGY		COURSE CODE: APT 317		CONTACT HOURS: 4 HOURS/WEEK	
		CREDIT UNIT: 4		THEORETICAL: 2 HOURS/WEEK	
YEAR: I SEMESTER: I		PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL					
GOAL: This course is designed to equip students with knowledge and skills in the physiology of farm and companion animals					
GENERAL OBJECTIVE 1.0: Understand the scope of animal physiology					
THEORETICAL CONTENT				PRACTICAL CONTENT	
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-2	1.1 Define physiology and related terms. 1.2 State levels of organisation. 1.3 Describe cell structure. 1.4 Describe membrane transport. 1.5 Describe cell cycle. 1.6 Describe homeostasis. 1.7 Describe primary tissues. 1.8 Describe cellular communication.	• Explain physiology, animal physiology, comparative physiology, applied physiology and clinical physiology. • Explain the levels of organisation of the animal body • Describe the structure of the animal cell • Explain membrane transport • Explain the cell cycle and its regulation • Explain the principles of homeostasis • Explain the four primary tissue types (epithelial, connective, muscle, nervous) and their functions.	White board, markers lecture notes, charts and projector Computer system Internet	• Examine prepared tissue slides under microscope (epithelial, connective, muscle, nervous). • Examine onion-skin cells stained with methylene blue for cell structure. • Calculate osmotic pressure using the van't Hoff equation.	• Guide students to: • Examine prepared tissue slides under microscope (epithelial, connective, muscle, nervous). • Examine onion-skin cells stained with methylene blue for cell structure. • Calculate osmotic pressure	Microscope, prepared slides (epithelial, connective, muscle, nervous). Onion bulb, glass slides, methylene blue. Calculator, homeostasis chart, PPE.

		• Discuss cellular communication		• Use a homeostasis simulation (e.g. body-temperature regulation diagram) to track responses to a stimulus.	using the van't Hoff equation. • Use a homeostasis simulation (e.g., body-temperature regulation diagram) to track responses to a stimulus.	
GENERAL OBJECTIVE 2.0: Know body fluids, blood, hemopoiesis, hemostasis, blood groups, immunity and the lymphatic system.						
3	2.1 Explain body-fluid compartments. 2.2 Explain electrolytes. 2.3 Describe blood composition. 2.4 Describe hematopoiesis. 2.5 Explain RBC physiology. 2.6 Explain WBC physiology. 2.7 Describe hemostasis. 2.8 Describe blood groups. 2.9 Explain immunity. 2.10 Explain the lymphatic system.	• Explain body-fluid compartments • Explain electrolytes • Explain blood composition • Discuss hematopoiesis (fetal: yolk sac → liver → bone marrow; adult: bone marrow); hematopoietic stem cells. • Explain RBC physiology • Explain WBC physiology	White board, markers lecture notes, charts and projector Computer system Int ern et	• Determine packed cell volume (PCV) using microhematocrit. • Count RBC and WBC using a hemocytometer. • Stain a blood smear with Giemsa. • Count the differential WBC.	Guide students to: • Determine PCV. • Count RBC and WBC. • Prepare blood smear and count differential.	Microhaematocrit centrifuge, capillary tubes, sealant, PCV reader. Haemocytometer, WBC/RBC diluting fluid, microscope. Blood sample Giemsa stain, methanol, slides, cover-slips. PP E.

		• Discuss hemostasis and blood coagulation • Describe immunity Explain the lymphatic system				
GENERAL OBJECTIVE 3.0: Understand cardiovascular physiology —						
4	3.1 Explain heart anatomy and cardiac muscle. 3.2 Explain the cardiac cycle. 3.3 Explain the conduction system and ECG. 3.4 Describe heart-rate regulation. 3.5 Explain blood pressure and its regulation. 3.6 Explain peripheral circulation. 3.7 Explain special circulations. 3.8 Explain shock.	• Explain the heart anatomy briefly (chambers, valves) and cardiac muscle characteristics. • Explain the cardiac cycle • Explain the conduction system • Explain heart-rate regulation • Explain stroke volume, cardiac output (CO = HR × SV), ejection fraction. • Explain peripheral circulation • Explain special	White board, markers lecture notes, charts and projector Computer system Internet	• Take pulse rate at common pulse points (mandibular, coccygeal, femoral) on different species. • Demonstrate the effect of exercise/activity on heart rate. • Calculate cardiac output from given heart rate and stroke volume data.	Guide students to: • Take pulse rate at common pulse points (mandibular, coccygeal, femoral) on different species. • Demonstrate the effect of exercise/activity on heart rate. • Calculate cardiac output from given heart rate and stroke volume data.	Stethoscope, sphygmomanometer / Live animals (cattle, dog, sheep). Calculator, ECG reports, PPE.

		circulations • Describe shock (hypovolemic, cardiogenic, septic) and the physiological responses.				
GENERAL OBJECTIVE 4.0: Understand respiratory physiology						
5	4.1 Explain respiratory anatomy. 4.2 Explain mechanics of ventilation. 4.3 Describe gas exchange. 4.4 Describe regulation of respiration. 4.5 Describe acid-base balance 4.6 Explain special respiration.	• Discuss respiratory anatomy • Explain the mechanics of ventilation • Describe gas exchange at the alveolar-capillary membrane. • Explain transport of CO_2 • Discuss regulation of respiration • Explain acid-base balance and the role of the respiratory system • Describe special respiration	White board, markers lecture notes, charts and projector Computer system Internet	• Measure respiratory rate on different species (cattle, sheep, pig, dog, poultry). • Demonstrate the effect of exercise on respiratory rate. • Demonstrate panting in a dog after exercise; observe panting frequency. • Examine an avian (chicken) post-mortem to identify air sacs and bronchi. •	Guide students to: • Measure respiratory rate. • Demonstrate the exercise effect. • Observe panting. • Examine the avian respiratory tract.	Stethoscope, watch. Live animals (dog, cattle, poultry). Post-mortem chicken specimen. Calculator, recording sheets, PPE.
GENERAL OBJECTIVE 5.0: Understand comparative digestive physiology						

6-7	5.1 Describe the general digestive process. 5.2 Describe monogastric (simple-stomach) digestion in pig, dog and cat. 5.3 Describe ruminant digestion. 5.4 5.4 Describe rumen microbiology. 5.5 Describe avian digestion. 5.6 Describe rabbit digestion. 5.7 Describe absorption mechanisms in the small intestine. 5.8 Describe the role of the accessory organs.	•Explain the general digestive process. •Explain monogastric digestion. •Explain ruminant digestion. •Discuss rumen microbiology. •Describe rumen development in young ruminants. •Describe avian digestion. •Explain equine digestion. •Explain rabbit digestion. •Explain absorption. • Describe accessory organs.	Charts Projector, whiteboard, Reference textbooks, internet.	•Examine post-mortem GI tracts of pig, ruminant (cow/goat), poultry and rabbit; identify and measure each segment. •Conduct rumen-fluid microscopy — count protozoa and observe bacteria. •Test the effect of pH on rumen fluid using sodium hydroxide and acetic-acid drops. •Demonstrate amylase activity using starch and saliva (or pancreatic extract); test with iodine. •Demonstrate pepsin/HCl digestion of egg white at	Guide students to: •Examine post-mortem GI tracts of pig, ruminant (cow/goat), poultry and rabbit; identify and measure each segment. •Conduct rumen-fluid microscopy — count protozoa and observe bacteria. •Demonstrate the effect of pH on rumen fluid using sodium hydroxide and acetic-acid drops. •Demonstrate amylase activity using starch and saliva (or pancreatic extract); test with iodine. Demonstrate pepsin/HCl	Post-mortem GI specimens, dissecting tools. Stomach tube, rumen-fluid containers, pH meter. Microscope, slides, cover-slips. Starch solution, iodine, saliva. Egg white, HCl, pepsin. Vegetable oil, bile salts, water, test tubes. PPE.

				different pH levels.	digestion	
GENERAL OBJECTIVE 6.0: Understand excretory and urinary physiology, kidney function, fluid-electrolyte regulation and thermoregulation.						
8-9	6.1 Explain nephron structure (glomerulus, Bowman's capsule, PCT, loop of Henle, DCT, collecting duct). 6.2 Describe glomerular filtration. 6.3 Describe tubular reabsorption. 6.4 Describe tubular secretion. 6.5 Explain the counter-current multiplier (loop of Henle) and its role in concentrating urine. 6.6 Describe regulation of urine. 6.7 Describe acid-base balance regulation by the kidney. 6.8 Describe the avian renal-portal system and uric-acid excretion. 6.9 Explain thermoregulation 6.10 Describe sweating, panting, vasodilation and vasoconstriction thermoregulation. 6.11 Explain heat stress and cold stress in farm animals.	• Explain nephron structure. • Discuss glomerular filtration. • Discuss tubular reabsorption. • Describe tubular secretion. • Discuss the counter-current multiplier. • Describe ADH, aldosterone and RAAS. • Explain acid-base balance. • Describe avian renal physiology. • Describe thermoregulation. • Describe sweating, panting and vasomotor responses. •Discuss heat and cold stress.	Charts Projector, whiteboard, Reference textbooks, internet.	• Examine kidney specimens (cattle, dog, poultry). • Identify cortex, medulla and calyces. • Examine urine sediment under microscope — crystals, casts, cells. • Measure body temperature on cattle, sheep, dog and poultry at rest and after exercise/heat exposure. •Demonstrate the effect of heat exposure on respiratory rate of a dog.	Guide students to: • Examine kidney specimens (cattle, dog, poultry); identify cortex, medulla and calyces. • Examine urine sediment under microscope — crystals, casts, cells. • Measure body temperature on cattle, sheep, dog and poultry at rest and after exercise/heat exposure Demonstrate the effect of heat exposure on respiratory rate of a dog.	Post-mortem kidney specimens. Microscope, slides. Thermometer, watch, calculator. Live animals, PPE.
GENERAL OBJECTIVE 7.0: Know endocrine physiology						
10-11	7.1 Describe the endocrine system. 7.2 Explain the hypothalamic-	• Explain the endocrine	Charts Projector,	• Examine post-mortem	Guide students to:	Post-mortem specimens

	pituitary axis. 7.3 Explain thyroid hormones 7.4 Explain parathyroid hormone (PTH); calcium and phosphorus regulation; vitamin D. 7.5 Explain the adrenal cortex. 7.6 Describe pancreatic hormones. 7.7 Explain reproductive hormones. 7.8 Describe gastrointestinal hormones. 7.9 Describe stress hormones and the general adaptation syndrome.	system. • Explain hormone-action mechanisms. • Discuss the hypothalamic-pituitary axis. • Discuss thyroid hormones. • Describe PTH and Ca^{2+} regulation. • Describe adrenal hormones. • Describe pancreatic hormones. • Explain reproductive hormones. • Describe GI hormones. • Discuss stress hormones.	whiteboard, Reference textbooks, internet.	specimens of thyroid, parathyroid, adrenal, pancreas and pituitary glands. • Demonstrate the effect of oxytocin on milk let-down (by injection in a goat or via observation in a lactating animal). • Perform a glucose-challenge test (oral) on a dog and follow blood glucose at 30, 60, 90 and 120 min. • Identify hormone-producing tissues on histology slides.	• Examine post-mortem specimens of thyroid, parathyroid, adrenal, pancreas and pituitary glands. • Demonstrate the effect of oxytocin on milk let-down (by injection in a goat or via observation in a lactating animal). • Demonstrate a glucose-challenge test (oral) on a dog and follow blood glucose at 30, 60, 90 and 120 min. Identify hormone-producing tissues on histology slides	(thyroid, adrenal, pituitary, pancreas). Oxytocin, GnRH, Syringes, needles, Microscope, prepared slides. PPE.
GENERAL OBJECTIVE 8.0: Understand reproductive physiology and lactation						
12-13	8.1 Explain male reproductive physiology.	• Explain male reproductive	Charts Projector,	• Examine post-mortem	Guide students to:	Post-mortem reproductive

	8.2 Explain female reproductive physiology. 8.3 Explain the estrous cycle. 8.4 Explain seasonal vs continuous breeders; the photoperiod effect. 8.5 Explain fertilization, cleavage, blastocyst formation, implantation. 8.6 Explain pregnancy maintenance. 8.7 Describe parturition. 8.8 Describe lactation. 8.9 Describe milk composition. 8.10 Explain colostrum.	physiology. • Describe female reproductive physiology. • Explain the estrous cycle. • Explain seasonal vs continuous breeders. • Describe fertilization and placentation. • Describe pregnancy maintenance. • Explain parturition. • Describe puerperium. • Explain lactation. • Describe milk composition. • Describe colostrum.	whiteboard, Reference textbooks, internet	reproductive tracts (male and female) of cattle, sheep, goat, pig and poultry. • Identify structures. • Examine sperm under microscope — assess motility, morphology and count. • Detect oestrus signs in cattle/sheep using direct observation. • Examine mammary-gland tissue at different physiological states (non-lactating, lactating, dry). • Conduct California Mastitis Test (CMT) on milk samples.	• Examine reproductive tracts. • Examine sperm. • Detect oestrus. • Examine mammary tissue. • Determine milk composition. Conduct CMT.	tracts. Microscope, slides, haemocytometer. Mammary tissue specimens. Fresh milk sample CMT paddle and reagent, milk samples, PPE.
GENERAL OBJECTIVE 9.0: Understand neurophysiology, muscle physiology, special senses and stress physiology in production						

animals.						
	9.1 Describe the nervous system. 9.2 Describe the structure of the neuron. 9.3 Explain the resting membrane potential and action-potential generation and propagation. 9.4 Explain synaptic transmission. 9.5 Explain the reflex arc. 9.6 Describe muscle physiology. 9.7 Explain the eye. 9.8 Explain the ear. 9.9 Explain smell (olfaction). 9.10 Explain taste. 9.11 Explain touch, pain and temperature sensation.	• Explain the nervous system. • Explain neuron structure. • Discuss membrane potentials and action potentials. • Describe synaptic transmission. • Describe the reflex arc. • Explain muscle physiology.	Charts Projector, whiteboard, Reference textbooks, internet.	• Examine post-mortem brain specimens (cattle/dog/sheep); identify cerebrum, cerebellum, brainstem and spinal cord. • Observe simple reflexes. • Examine eye specimens — identify cornea, lens, retina and tapetum lucidum. • Examine sheep/goat skull to identify ear structures.	Guide students to: • Examine post-mortem brain specimens (cattle/dog/sheep); identify cerebrum, cerebellum, brainstem and spinal cord. • Observe simple reflexes • Examine eye specimens — identify cornea, lens, retina and tapetum lucidum. • Examine sheep/goat skull to identify ear structures.	Post-mortem brain, eye and ear specimens. Reflex hammer, light source. Live animals (dog, cattle, sheep). PPE.
14-15	8.11 Explain stress in production animals.	• Explain vision. • Discuss hearing and balance. • Explain smell and the flehmen response. • Describe taste. • Describe touch, pain and temperature. • Describe stress and the HPA axis. • Discuss stress in production animals.				

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

LIVESTOCK FARM PRACTICE I

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: LIVESTOCK FARM PRACTICE I	**COURSE CODE: APT 318**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: I SEMESTER: I	**PRE-REQUISITE**	**PRACTICAL: 3 HOURS/WEEK**
GOAL: This course is designed to provide students with knowledge and skills in livestock farm practice		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand occupational health and safety 2.0 Know humane and safe handling and restraint techniques. 3.0 Understand daily husbandry routines for cattle (dairy and beef); 4.0 Know daily husbandry routines for sheep and goat; 5.0 Comprehend daily husbandry routines for pigs; 6.0 Understand daily husbandry routines for poultry; 7.0 Know pasture establishment, fodder production and forage conservation; 8.0 Comprehend how to operate, clean, maintain and safely use common farm tools; 9.0 Know basic farm records and production of simple farm reports.		

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY						
COURSE TITLE: LIVESTOCK FARM PRACTICE I			**COURSE CODE: APT 318**		**CONTACT HOURS: 4 HOURS/WEEK**	
			CREDIT UNIT: 4		**THEORETICAL: 1 HOUR/WEEK**	
YEAR: I SEMESTER: I			**PRE-REQUISITE:**		**PRACTICAL: 3 HOURS/WEEK**	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills in livestock farm practice						
GENERAL OBJECTIVE 1.0: Understand occupational health and safety.						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Explain the objectives, scope and importance of livestock farm practice in animal production. 1.2 Describe the layout of the institutional teaching farm. 1.3 Describe the management structure of a livestock farm. 1.4 Describe occupational health and safety (OHS) in livestock practice. 1.5 Explain personal protective equipment (PPE). 1.6 Outline biosecurity principles. 1.7 Outline professional ethics and welfare codes (WOAH Five	• Explain objectives and scope of livestock farm practice. • Discuss institutional farm layout. • Describe management structure. • Describe OHS in livestock practice. • Describe PPE selection. • Explain biosecurity principles. • Explain professional ethics and welfare codes.	Whiteboard, markers, projector, charts. Sample farm-layout map. reference textbooks, internet,	• Identify all units and zones. • Sketch the layout of the institutional farm to scale. • Mark biosecurity zones (red/amber/green) . • Demonstrate proper donning and doffing of PPE. • Demonstrate hand-washing, footbath dipping and visitor-log entry. Develop a draft daily/weekly programme for the institutional farm.	Guide students to: • Identify all units and zones. • Sketch the layout of the institutional farm to scale; mark biosecurity zones (red/amber/green) . • Demonstrate proper donning and doffing of PPE. • Demonstrate hand-washing, footbath dipping and visitor-log entry. Develop a draft daily/weekly programme for the institutional farm	Institutional teaching farm. PPE (overalls, boots, gloves, masks, head caps). Footbath, disinfectant, visitor log. Drawing paper, ruler, pencil. Daily-programme template.

	Domains / Five Freedoms) at introductory level. 1.8 Describe the daily and weekly programme of a livestock farm.	Explain daily and weekly programme.				
GENERAL OBJECTIVE 2.0: Know humane and safe handling and restraint techniques.						
2	2.1 Define handling, restraint and humane handling. 2.2 Describe restraint of cattle. 2.3 Describe restraint of sheep and goat. 2.4 Describe restraint of pig 2.5 Describe restraint of poultry. 2.6 Describe restraint of dog and cat. 2.7 Describe handler safety. 2.8 Outline introduction to the WOAH Five Domains of welfare.	• Explain handling and restraint. • Describe principles of safe handling. • Describe restraint of cattle. • Discuss restraint of sheep/goat. • Describe restraint of pig. • Describe restraint of poultry. • Describe restraint of dog/cat. • Describe handler safety. • Explain Five Domains of welfare.	Charts. Projector, whiteboard, Reference textbooks, internet etc.	• Demonstrate halter application, head-gate restraint and tail jack on cattle. • Demonstrate lap restraint on sheep and goat. • Demonstrate snare restraint on pig. • Demonstrate single-hand and two-hand poultry restraint. •	Guide students to: • Demonstrate restraint of cattle. • Demonstrate restraint of sheep and goat. • Demonstrate restraint of pig. • Demonstrate restraint of poultry.	Live animals (cattle, sheep, goat, pig, poultry). Halters, head-gate, casting ropes, tail strap. Pig snare, hurdle and PPE.
GENERAL OBJECTIVE 3.0: Understand daily husbandry routines for cattle (dairy and beef)						
3-4	3.1 Describe the daily	• Describe daily	Charts.	• Conduct morning	• Guide students to:	Cattle, feeders,

	routine for dairy cattle. 3.2 Describe the daily routine for beef cattle. 3.3 Describe basic feeds for cattle. 3.4 Describe milking-parlour preparation. 3.5 Describe cleaning and sanitation of pens and parlours. 3.6 Describe behavioural observation. 3.7 Describe signs of healthy vs sick cattle. 3.8 Describe paddock rotation and grazing management. 2.9 Describe water-supply systems.	dairy-cattle routine. • Describe daily beef-cattle routine. • Describe basic feeds and feeders. • Describe milking-parlour preparation. • Describe pen cleaning and sanitation. • Describe behavioural observation. • Describe healthy vs sick signs. • Describe paddock rotation. • Describe water-supply systems.	Projector, whiteboard. Reference textbooks, internet,	and evening feeding and watering of cattle at the institutional farm. • Clean cattle pens and feeders/waterers. • Remove manure and bedding. • Conduct manual milking on a cow. • Demonstrate strip-cup test and foremilk discard. • Record cattle behaviour for one full day. • Document feeding, drinking, lying and cudding. • Identify healthy and sick cattle from clinical signs; report to supervisor. • Move cattle from one paddock to another using a low-stress technique. • Refill water troughs and	• Conduct morning and evening feeding and watering of cattle at the institutional farm. • Clean cattle pens and feeders/waterers. • Remove manure and bedding. • Conduct manual milking on a cow demonstrate strip-cup test and foremilk discard. • Observe and record cattle behaviour for one full day; document feeding, drinking, lying and cudding. • Identify healthy and sick cattle from clinical signs; report to supervisor. • Move cattle from one paddock to another using a low-stress technique.	waterers. Forage, concentrate, salt-lick. Bucket, brush, scraper, fork, wheelbarrow. Milking pail, strip cup, teat dip, cleaning cloths. Recording sheets, clipboard. Halter, sorting gate, PPE.

				check water flow.	Refill water troughs and check water flow.	
GENERAL OBJECTIVE 4.0: Know daily husbandry routines for sheep and goat						
5	4.1 Describe the daily routine for sheep and goat. 4.2 Describe housing systems for small ruminants. 4.3 Describe feeds concentrate, salt and water. 4.4 Describe behavioural observation. 4.5 Describe signs of healthy vs sick small ruminants. 4.6 Describe routine hoof care, fly control and dipping/spraying. 3.9 Describe weaning of lambs and kids.	• Describe daily small-ruminant routine. • Describe housing systems. • Describe feeds. • Describe behavioural observation. • Describe healthy vs sick signs. • Describe routine hoof and fly control. • Describe weaning. •	Charts. Projector, whiteboard, Reference textbooks, internet,	• Conduct morning and evening feeding and watering of sheep and goat. • Clean small-ruminant pens and feeders. • Observe behaviour for one full day. • Trim hooves on a goat using hoof shears (basic technique). • Demonstrate dipping/spraying with an acaricide. • Record observations on a small-ruminant register.	• Guide students to: • Conduct morning and evening feeding and watering of sheep and goat. • Clean small-ruminant pens and feeders • Observe behavior for one full day; document. • Trim hooves on a goat using hoof shears (basic technique). • Demonstrate dipping/spraying with an acaricide. • Record observations on a small-ruminant register.	Sheep, goats, feeders, waterers. Forage, concentrate, salt, water. Bucket, brush, fork, wheelbarrow. Acaricide, dipping vat or knapsack sprayer. Recording sheets, PPE.
GENERAL OBJECTIVE 5.0: Comprehend daily husbandry routines for pigs						
6	5.1 Describe the daily routine for pigs. 5.2 Describe housing systems for pigs. 5.3 Describe feeds. 5.4 Describe behavioural	• Describe daily pig routine. • Describe housing systems. • Describe feeds.	Charts. Projector, whiteboard, Reference textbooks, internet,	• Conduct morning and evening feeding and watering of pigs. • Clean pig pens. • Remove manure	Guide students to: • Conduct morning and evening feeding and watering of pigs. • Clean pig pens;	Pigs, pens, feeders, waterers. Pig feed (starter, grower, finisher). Bucket, brush, scraper, fork,

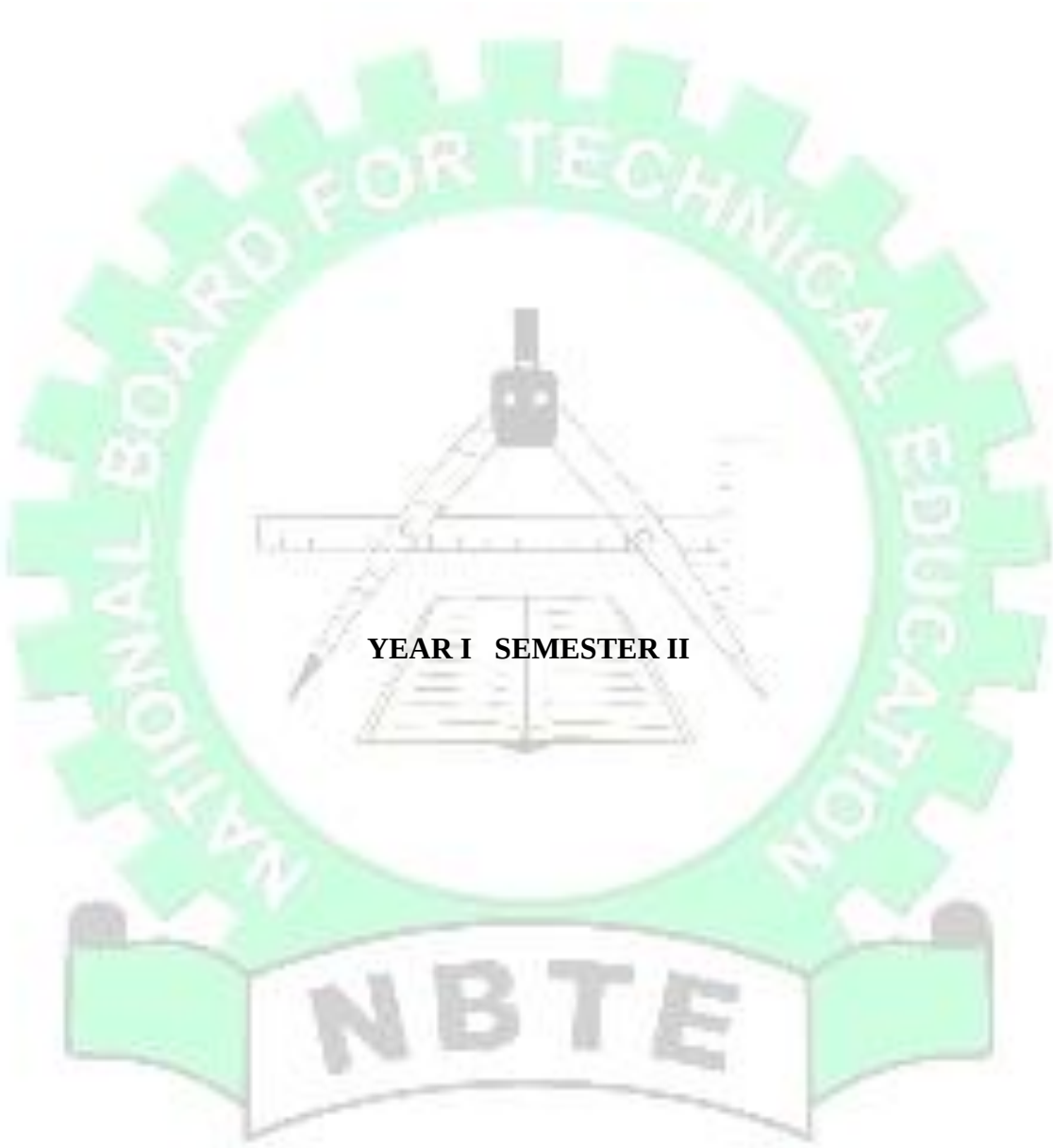
	observation. 5.5 Describe signs of healthy vs sick pigs. 5.6 Describe weaning of piglets and grouping by age/weight. 5.7 Describe routine fly and parasite control.	• Describe behavioural observation. • Describe healthy vs sick signs. • Describe weaning and grouping. • Describe fly and parasite control.		and bedding. • Observe pig behaviour for one full day. • Identify oestrus signs in sows. • Record in a register. • Identify healthy and sick pigs from clinical signs; report. • Demonstrate routine spraying for ectoparasites. • Group weaners by age/weight.	remove manure and bedding. • Observe pig behaviour for one full day; document. • Identify oestrus signs in sows; record in a register. • Identify healthy and sick pigs from clinical signs; report. •	wheelbarrow. Disinfectant, sprayer. Recording sheets, weighing scale, PPE.
GENERAL OBJECTIVE 6.0: Understand daily husbandry routines for poultry						
7-8	6.1 Describe types of poultry 6.2 Describe housing systems 6.3 Describe brooder management 6.4 Describe the daily routine 6.5 Describe feeds 6.6 Describe water management 6.7 Describe behavioral observation 6.8 Describe signs of healthy vs sick poultry 6.9 Describe routine egg	• Describe types of poultry. • Describe housing systems. • Describe brooder management. • Describe daily routine. • Describe feeds. • Describe water management. • Describe behavioural observation.	Charts. Projector, whiteboard, Reference textbooks, internet,	• Set up a brooder for day-old chicks. • Clibrate temperature and stocking density. • Record feed consumption. • Conduct daily mortality count and pickup. • Record in register. • Collect eggs from layer pens. • Cleaning and	Guide students to: • Set up a brooder for day-old chicks; calibrate temperature and stocking density. • Record feed consumption. • Conduct daily mortality count and pickup; record in register. • Collect eggs from layer pens; clean and grade. • Clean a poultry	Day-old chicks, broiler/layer flock. Brooder, brooder lamps, thermometer. Feed (chick, grower, layer mash), water. Feeders, waterers. Disinfectant, sprayer, broom. Recording sheets, PPE.

	collection, candling and storage. 6.10 Describe litter management and cleaning between flocks (all-in/all-out).	• Describe healthy vs sick signs. • Describe egg collection and storage. • Describe litter management.		grading of eggs. • Clean a poultry house between flocks (all-in/all-out cycle). • Observe poultry behaviour for one full day.	house between flocks (all-in/all-out cycle). Observe poultry behaviour for one full day.	
GENERAL OBJECTIVE 7.0: Know pasture establishment, fodder production and forage conservation						
9-10	7.1 List types of pasture and forage. 7.2 Explain pasture establishment. 7.3 Describe pasture management. 7.4 Discuss fodder conservation. 7.5 Describe by-products as forage. 7.6 Describe water management on pasture. 7.7 Describe browsing vs grazing for sheep and cattle.	• Describe types of pasture and forage • Describe pasture establishment • Describe pasture management • Describe fodder conservation • Describe agricultural by-products as forage • Describe water management on pasture Describe browsing for goats vs grazing for sheep and cattle.	Charts. Projector, whiteboard, Reference textbooks, internet,	• Identify common tropical grass and legume species at the institutional pasture or from samples. • Carry out land preparation and planting of elephant-grass cuttings on a small plot. • Apply fertiliser and weed-control on an established pasture. • Cut, dry and bale hay from pasture. • Store in shed. • Prepare a small silage in a 25-kg bag (chopped grass + molasses + 24-h compaction).	• Guide students to: • Identify common tropical grass and legume species at the institutional pasture or from samples. • Carry out land preparation and planting of elephant-grass cuttings on a small plot. • Apply fertiliser and weed-control on an established pasture. • Cut, dry and bale hay from pasture; store in shed. • Prepare a small silage in a 25-kg bag (chopped grass + molasses + 24-h	Pasture and forage field. Cuttings, seeds, fertiliser, herbicide. Hoes, cutlasses, knapsack sprayer. Sickle, rake, baler/twine, hay shed. 25-kg silage bags, molasses, chopper. Crop-residue samples. Calculator, recording sheets, PPE.

				• Sample crop residues (rice straw, maize stover, groundnut haulms) and prepare for storage. • Compute stocking rate (AU/ha) for a sample paddock.	compaction). • Sample crop residues (rice straw, maize stover, groundnut haulms) and prepare for storage. Compute stocking rate.	
GENERAL OBJECTIVE 8.0: Comprehend how to operate, clean, maintain and safely use common farm tools, hand-implements and basic farm machinery.						
11-12	8.1 Explain common farm tools. 8.2 Explain hand-implements for livestock. 8.3 Describe basic farm machinery. 8.4 Describe principles of safe operation. 8.5 Describe routine care 8.6 Explain basic maintenance. 8.7 Explain simple fault diagnosis — engine doesn't start, tractor. overheats, mill clogs. 7.8 Explain a maintenance log-sheet and spare-parts inventory.	• Explain farm tools and hand-implements. • Describe livestock hand-implements. • Describe basic farm machinery. • Explain safe operation. • Describe routine care. • Discuss basic maintenance. • Explain simple fault diagnosis. • Explain maintenance logs and spare parts.	Charts. Projector, whiteboard, Reference textbooks, internet,	• Identify and use farm tools (cutlass, hoe, fork, spade) on a sample task. • Operate hand-implements — knapsack sprayer, drenching gun, ear-tagging plier, hoof shears, milking pail. • Demonstrate cleaning, sharpening and oiling of cutlasses, hoes and sickles. • Set up a maintenance log-sheet and spare-	Guide students to: • Identify and use farm tools. • Operate hand-implements. • Clean and sharpen tools. • Operate tractor and mower. • Operate hammer mill and feed-mixer. • Conduct maintenance check. • Set up maintenance log.	Cutlass, hoe, fork, spade, sickle, file. Knapsack sprayer, drenching gun, ear-tagging plier. Hoof shears, milking pail, strip cup. Lubricants, fuel, cleaning rags. Sharpening file, oil can. Maintenance log-sheet, PPE.

				parts register for the institutional farm.		
GENERAL OBJECTIVE 9.0: Know basic farm records and production of farm reports.						
13-15	9.1 Define farm record 9.2 Outline the importance of record-keeping 9.3 Describe types of farm records 9.4 Describe poultry-specific records 9.5 Describe dairy-specific records 9.6 Describe small-ruminant and pig records. 9.7 Describe livestock identification methods 9.8 Describe simple paper logbooks and introductory entry into Excel/Google Sheets. 8.8 Describe a weekly/monthly farm report (production summary, mortality, financial).	• Explain farm record and its importance. • Describe types of farm records. • Describe poultry-specific records. • Describe dairy-specific records. • Describe small-ruminant and pig records. • Describe identification methods. • Describe traceability. • Describe paper and introductory digital logbooks. • Describe weekly/monthly reports.	Charts. Projector, whiteboard, Reference textbooks, internet,	• Examine sample paper-based record forms used at the institutional farm. • Set up a poultry/dairy/pig logbook; capture one week of production, feed and health data. • Set up the same log in Excel/Google Sheets at introductory level. • Apply ear tags and ear notches on selected animals. • Record in register. • Generate a herd/flock register for one species. • Develop a weekly farm report covering production,	Guide students to: • Examine sample paper-based record forms used at the institutional farm. • Set up a poultry/dairy/pig logbook; capture one week of production, feed and health data. • Set up the same log in Excel/Google Sheets at introductory level. • Apply ear tags and ear notches on selected animals; record in register. • Generate a herd/flock register for one species. Develop a weekly farm report covering production,	Paper logbooks, sample record forms. Computers/laptops with Excel/Google Sheets. Tablets/smartphones. Ear tags, ear-tagging plier, ear-notching plier. Recording sheets, PPE.

				mortality and feed consumption.	mortality and feed consumption.	
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



YEAR I SEMESTER II

NUTRITIONAL BIOCHEMISTRY

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: NUTRITIONAL BIOCHEMISTRY	**COURSE CODE: APT 321**	**CONTACT HOURS: 3 HOURS/WEEK**
	CREDIT UNIT: 3	**THEORETICAL: 1 HOUR/WEEK**
YEAR: I SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 2 HOURS/WEEK**
GOAL: This course is designed to provide students with knowledge and skills of biochemical mechanisms by which nutrients are digested, absorbed, transported, and metabolized in farm animals		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the biochemistry of nutrient digestion and absorption in farm animals; 2.0 Know the biochemistry of carbohydrate metabolism and energy production in ruminants and non-ruminants; 3.0 Understand the biochemistry of lipid metabolism, transport and fatty acid utilisation in farm animals; 4.0 Understand protein and amino acid metabolism relevant to animal nutrition; 5.0 Know the biochemical roles and deficiency effects of vitamins and minerals in farm animals; 6.0 Understand water and electrolyte balance and their nutritional significance; 7.0 Know feed evaluation methods and nutritional biochemistry of feed ingredients.		

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: NUTRITIONAL BIOCHEMISTRY	COURSE CODE: APT 321	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: This course is designed to provide students with Knowledge and skills of biochemical mechanisms by which nutrients are digested, absorbed, transported and metabolised in farm animals		
GENERAL OBJECTIVE 1.0: Understand the biochemistry of nutrient digestion and absorption in farm animals.		

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1-2	1.1 Describe the gastrointestinal anatomy relevant to digestion in ruminants, monogastric, and poultry. 1.2 Explain the chemical events in the digestion of carbohydrates, proteins, and lipids. 1.3 Describe mechanisms of nutrient absorption in the small intestine. 1.4 Explain rumen fermentation: VFA production, microbial protein synthesis, and buffering. 1.2 1.5 Describe the role of enzymes in digestion and factors	• Explain the gastrointestinal anatomy relevant to digestion in ruminants, monogastric, and poultry. • Discuss the chemical events in the digestion of carbohydrates, proteins, and lipids. • Describe mechanisms of nutrient absorption in the small intestine. • Explain rumen fermentation: VFA production, microbial protein synthesis, and	Charts. Projector, whiteboard, Reference textbooks, internet	•Identify sections of the digestive tract using plastic models or charts of ruminant's vs monogastric. •Collect rumen fluid (from slaughter lab or simulated sample) and measure pH and identify odor characteristics.	Guide Students to: •Identify sections of the digestive tract using plastic models or charts of ruminant's vs monogastric. •Collect rumen fluid (from slaughter lab or simulated sample) and measure pH and identify odor characteristics.	Digestive tract models Charts PPE pH meter Rumen fluid samples Labware Gloves

	affecting enzyme efficiency.	buffering. • Describe the role of enzymes in digestion and factors affecting enzyme efficiency.				
General Objective 2.0: Know the biochemistry of carbohydrate metabolism and energy production in ruminants and non-ruminants						
3-4	2.1 Explain the differences between carbohydrate metabolism pathways in ruminants (VFA utilisation) vs. monogastric (glycolysis). 2.2 Describe glycolysis and its regulation in farm animals. 2.3 Explain the Krebs cycle and oxidative phosphorylation for ATP generation. 2.4 Explain gluconeogenesis and its importance in high-producing dairy cows (negative energy balance). 2.5 Describe glycogenolysis and its role in energy mobilisation.	• Explain the differences between carbohydrate metabolism pathways in ruminants (VFA utilisation) vs. monogastric (glycolysis). • Describe glycolysis and its regulation in farm animals. • Explain the Krebs cycle and oxidative phosphorylation for ATP generation. • Explain gluconeogenesis and its importance in high-producing dairy cows (negative energy balance). • Describe	Charts. Projector, whiteboard, Reference textbooks, internet	• Trace the glucose-to-ATP pathway on a metabolic map worksheet; calculate net ATP yield. • Calculate Metabolizable Energy (ME) from proximate analysis data using the Atwater factors	Guide students to: • Trace the glucose-to-ATP pathway on a metabolic map worksheet; calculate net ATP yield. • Calculate Metabolizable Energy (ME) from proximate analysis data using the Atwater factors	Printed metabolic maps Calculators Proximate Analysis table

	2.6 Explain the concept of energy partitioning (ME, NE) in animal feeding.	glycogenolysis and its role in energy mobilisation. • Explain the concept of energy partitioning (ME, NE) in animal feeding				
General Objective 3.0: Understand the biochemistry of lipid metabolism, transport and fatty acid utilisation in farm animals.						
5-6	3.1 Describe beta-oxidation of fatty acids and ATP yield. 3.2 Explain lipogenesis and its regulation in fat-depositing animals. 3.3 Describe ketogenesis and the clinical relevance of ketosis in dairy cows and ewes. 3.4 Describe lipoprotein classes and their role in lipid transport in blood. 3.5 Explain the significance of essential fatty acids (omega-3, omega-6) in poultry and swine nutrition. 3.6 Describe the effects of dietary fat on egg yolk composition and	• Describe beta-oxidation of fatty acids and ATP yield. • Explain lipogenesis and its regulation in fat-depositing animals. • Describe ketogenesis and the clinical relevance of ketosis in dairy cows and ewes. • Describe lipoprotein classes and their role in lipid transport in blood. • Explain the significance of essential fatty acids (omega-3, omega-6) in poultry and swine nutrition. • Describe the	Charts. Projector, whiteboard, Reference textbooks, internet	• Perform a urine ketone strip test on provided sample. • Record and interpret results. • Analyze fat content of two feed samples using the ether extraction (Soxhlet) method or hand-held NIR	Guide students to: • Perform a urine ketone strip test on provided sample; record and interpret results. • Analyze fat content of two feed samples using the ether extraction (Soxhlet) method or hand-held NIR	Ketone test strips Urine samples (simulated) Gloves Soxhlet apparatus or NIR device Feed samples Labware

	milk fat content.	effects of dietary fat on egg yolk composition and milk fat content.				
General Objective 4.0: Understand protein and amino acid metabolism relevant to animal nutrition.						
7-8	4.1 Explain transamination and deamination reactions and their significance. 4.2 Describe the urea cycle and modes of nitrogen excretion in mammals, aves, and reptiles. 4.3 Explain microbial degradation of dietary protein in the rumen (RDP vs. UDP). 4.4 Describe limiting amino acids for poultry and swine and their roles in production. 4.5 Explain the concept of ideal protein and amino acid balance. 4.6 Describe protein turnover and its implications for feed efficiency.	• Describe beta-oxidation of fatty acids and ATP yield. • Explain lipogenesis and its regulation in fat-depositing animals. • Describe ketogenesis and the clinical relevance of ketosis in dairy cows and ewes. • Describe lipoprotein classes and their role in lipid transport in blood. • Explain the significance of essential fatty acids (omega-3, omega-6) in poultry and swine nutrition. 3.6 Describe the effects of dietary fat on egg yolk composition and milk fat content.	Charts. Projector, whiteboard, Reference textbooks, internet etc.	•Determine crude protein content of a feed sample using the Kjeldahl method (demonstration or simulation). •Calculate the amino acid score of a sample diet against NRC requirements for broilers; identify limiting amino acids.	Guide a Student to: •Determine crude protein content of a feed sample using the Kjeldahl method (demonstration or simulation). •Calculate the amino acid score of a sample diet against NRC requirements for broilers; identify limiting amino acids.	Kjeldahl apparatus Feed samples Labware NRC amino acid requirement tables Feed composition tables Calculators

General Objective 5.0: Know the biochemical roles and deficiency effects of vitamins and minerals in farm animals.						
8-9	5.1 Describe the biochemical functions of fat-soluble vitamins (A, D, E, K) with deficiency signs in farm animals. 5.2 Describe the biochemical functions of water-soluble vitamins (B-complex, C) and their metabolic roles. 5.3 Explain the biochemical functions of macro-minerals (Ca, P, Mg, Na, K, Cl, S) and their interactions. 5.4 Describe the roles of trace minerals (Fe, Zn, Cu, Mn, Se, I, Co) as enzyme cofactors and in metabolic processes. 5.5 Explain mineral bioavailability and antagonism (e.g. Ca:P ratio, Zn:Cu interaction).	• Describe the biochemical functions of fat-soluble vitamins (A, D, E, K) with deficiency signs in farm animals. • Describe the biochemical functions of water-soluble vitamins (B-complex, C) and their metabolic roles. • Explain the biochemical functions of macro-minerals (Ca, P, Mg, Na, K, Cl, S) and their interactions. • Describe the roles of trace minerals (Fe, Zn, Cu, Mn, Se, I, Co) as enzyme cofactors and in metabolic processes. • Explain mineral bioavailability and antagonism (e.g. Ca:P ratio, Zn:Cu interaction).	Whiteboard Marker Deficiency photo charts Slides Mineral interaction charts Textbooks	• Examine specimens or photos showing vitamin deficiency signs; match to causal vitamin and biochemical pathway affected. • Calculate dietary Ca:P ratio for a sample ration; assess adequacy against recommended values for layers.	Guide students to: • Examine specimens or photos showing vitamin deficiency signs; match to causal vitamin and biochemical pathway affected. • Calculate dietary Ca:P ratio for a sample ration; assess adequacy against recommended values for layers.	Deficiency photo sets Worksheets Feed composition tables Calculators NRC layer standards

General Objective 6.0: Understand water and electrolyte balance and their nutritional significance.						
10-11	6.1 Explain the physiological and biochemical roles of water in nutrient transport, thermoregulation, and metabolic reactions. 6.2 Describe electrolyte balance. 6.3 Explain dehydration, its biochemical consequences, and indicators in farm animals. 6.4 Describe the role of water in rumen fermentation efficiency and milk production. 6.5 Explain water quality parameters and their effect on animal performance.	• Explain the physiological and biochemical roles of water in nutrient transport, thermoregulation, and metabolic reactions. • Describe electrolyte balance (Na+, K+, Cl−) and dietary electrolyte balance (DEB) concept in poultry and swine. • Explain dehydration, its biochemical consequences, and indicators in farm animals. • Describe the role of water in rumen fermentation efficiency and milk production. • Explain water quality parameters and their effect on animal performance.	Charts. Projector, whiteboard, Reference textbooks, internet	• Measure water intake of broiler birds over 24 hrs under two ambient temperature conditions. • Test a water sample for pH, TDS, and nitrate content using field test kits. • Evaluate against livestock water quality standards.	Guide students to: • Measure water intake of broiler birds over 24 hrs under two ambient temperature conditions • Test a water sample for pH, TDS, and nitrate content using field test kits. • Evaluate against livestock water quality standards.	Water meters or measuring buckets Data recording sheets Thermometers Water quality test kits Water samples Worksheets
General Objective 7.0: Know feed evaluation methods and nutritional biochemistry of feed ingredients.						

12-15	7.1 Describe proximate analysis (Weende analysis) and its biochemical basis. 7.2 Explain the limitations of proximate analysis and the role of the Van Soest (ADF/NDF) system for forages. 7.3 Describe biological methods of feed evaluation (biological value, net protein utilisation, digestibility trials). 7.4 Explain the nutritional biochemistry of common Nigerian feed ingredients: maize, soybean meal, fish meal, groundnut cake, palm kernel cake, cassava peels. 7.5 Describe anti-nutritional factors in plant feeds (trypsin inhibitors, phytates, tannins, gossypol) and their biochemical effects. 7.6 Explain the	• Describe proximate analysis (Weende analysis) and its biochemical basis. • Explain the limitations of proximate analysis and the role of the Van Soest (ADF/NDF) system for forages. • Describe biological methods of feed evaluation (biological value, net protein utilisation, digestibility trials). • Explain the nutritional biochemistry of common Nigerian feed ingredients: maize, soybean meal, fish meal, groundnut cake, palm kernel cake, cassava peels. • Describe anti-nutritional factors in plant feeds (trypsin inhibitors, phytates, tannins, gossypol) and their	Charts. Projector, whiteboard, Reference textbooks, internet	• Perform dry matter determination and ash content for two feed ingredients (maize, soybean meal). • Formulate a simple least-cost diet for broiler finisher using local feed ingredients. • Verify protein and energy meet NRC standards.	Guide students to: • Perform dry matter determination and ash content for two feed ingredients (maize, soybean meal); calculate and compare. • Formulate a simple least-cost diet for broiler finisher using local feed ingredients; verify protein and energy meet NRC standards.	Feed composition tables NRC standards Calculators or laptops

	biochemistry of feed processing methods (toasting, pelleting, fermentation) on nutrient bioavailability.	biochemical effects. • Explain the biochemistry of feed processing methods (toasting, pelleting, fermentation) on nutrient bioavailability				

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

FIELD EXPERIMENTATION AND DATA ANALYSIS FOR LIVESTOCK VALUE CHAIN

<table>
<tr><td colspan="3">PROGRAMME: HIGHER DIPLOMA ANIMAL HEALTH PRODUCTION TECHNOLOGY</td></tr>
<tr><td rowspan="2">COURSE TITLE: FIELD EXPERIMENTATION AND DATA ANALYSIS FOR LIVESTOCK VALUE CHAIN</td><td>COURSE CODE: APT 322</td><td>CONTACT HOURS: 3 HOURS/WEEK</td></tr>
<tr><td>CREDIT UNIT: 3</td><td>THEORETICAL: 1HOUR/WEEK</td></tr>
<tr><td>YEAR: I SEMESTER: II</td><td>PRE-REQUISITE:</td><td>PRACTICAL: 2 HOURS/WEEK</td></tr>
<tr><td colspan="3">GOAL: This course is designed to equip students with knowledge and skills to collect, analyze, interpret data and conduct simple field experiment</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVES: On completion of this course, the students should be able to:
1.0 Understand basic statistical concepts used in animal production;
2.0 Know how to collect and organize animal production data;
3.0 Understand data Presentation using tables, charts and graphs;
4.0 Know how to compute measures of central tendency and dispersion;
5.0 Understand the application of basic probability concepts in animal production;
6.0 Know how to design and conduct simple field experiments;
7.0 Know how to analyze and interpret experimental results;
8.0 Understand the application of experimental findings to improve animal production decisions.</td></tr>
</table>

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: FIELD EXPERIMENTATION AND DATA ANALYSIS	COURSE CODE: APT 322	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: This course is designed to equip students with knowledge and skills to collect, analyze, interpret data and conduct simple field experiment.		
GENERAL OBJECTIVE 1.0: Understand basic statistical concepts used in animal production		

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Define basic statistical terms. 1.2 Explain variables used in animal production. 1.3 State the importance of statistics in animal production decision-making.	• Explain basic statistical terms (nominal, ordinal, scales, ratio etc) used in animal production • Discuss variables used in animal production (e.g., weight, feed intake, milk yield) • Explain the importance of statistics in animal production decision-making	Charts. Projector, whiteboard, Reference textbooks, internet	• Identify types of data (qualitative and quantitative) in livestock systems. • Analyze case studies to distinguish between population and sample in farm studies.	Guide students to: • Identify types of data (qualitative and quantitative) in livestock systems • Distinguish between population and sample in farm studies	Farm records (feed intake, weight gain, egg production logs). Weighing scale (for animals or feed) Data recording sheets Calculators Live animals (poultry, goats, or cattle where available) Logbooks Computer system
General Objective 2.0: Know how to collect and organize animal production data						
	2.1 List the types of animal production data (health, production, sales	• Explain the types of animal production data (health,	Charts. Projector, whiteboard, Reference	• Collect real data from the farm (weight, feed	Guide students to: • Collect real data from the farm	Weighing scales (digital or manual) Feed containers and measuring tools

2-3	etc). 2.2 Discuss sources of animal production data. 2.3 Explain how to organize raw data into tables for analysis.	production, sales etc) • Discuss sources of animal production data • Explain how to organize raw data into tables for analysis	textbooks, internet	intake, egg count) • Use weighing scale and recording tools • Collect data in groups • Organize raw data into simple tables • Correct errors in data entry and proper recording techniques • Design simple data recording formats • Facilitate discussion on importance of accurate data collection	(weight, feed intake, egg count) • Use weighing scale and recording tools • Collect and record data in groups • Organize raw data into simple tables • Correct errors in data entry and proper recording techniques • Design simple data recording formats • Facilitate discussion on importance of accurate data collection	Egg trays (for poultry data collection) Farm animals (poultry, goats, cattle, etc.) Record books or data sheets Clipboards and pens Calculator or mobile devices (for recording support) Milk tank/chunck
General Objective 3.0: Understand data Presentation using tables, charts and graphs						
4-5	3.1 Explain the importance of data presentation in animal production. 3.2 Discuss the interpretation of presented data for decision-making in animal production. 3.3 Explain steps for constructing charts	• Explain the concept and importance of data presentation • Demonstrate different types of tables, charts, and graphs • Show examples using livestock data (weight gain, egg	Charts. Projector, whiteboard, Reference textbooks, internet	• Identify different methods of data presentation (tables, charts, graphs). • Construct simple tables from raw animal production data. • Draw basic charts (bar chart, pie chart,	Guide students to: • Provide raw animal production data for students to organize • Construct tables from raw data • Demonstrate drawing of bar	Graph sheets and drawing tools (rulers, pencils, erasers) Calculators Microsoft Excel or similar software (if available) Sample raw data from animal production records

	and graphs.	production, feed intake) • Explain steps for constructing charts and graphs • Guide students in interpreting visual data presentations • Ask questions to assess understanding		histogram). • Plot simple graphs (line graph) for livestock data trends.	charts, pie charts, and line graphs • Supervise students as they plot graphs manually or using Excel • Assist students in correcting errors in scaling and labeling • Facilitate group work on data presentation exercises	Clipboards and notebooks
General Objective 4.0: Understand measures of central tendency and dispersion						
6-7	4.1 Define measures of central tendency (mean, median, mode). 4.2 Define measures of dispersion (range, variance, standard deviation). 4.3 Explain steps to interpret results in relation to animal performance (e.g., weight variation, feed intake).	• Explain concepts of central tendency and dispersion • Demonstrate formulas and step-by-step calculations • Use examples from animal production (e.g., body weight, milk yield) • Solve sample problems on the board • Guide students through worked examples • Ask questions to test understanding	Charts. Projector, whiteboard, Reference textbooks, internet	• Compute mean, median, and mode from animal production data. • Calculate range and standard deviation from given datasets. • Use MS Excel for calculations.	Guide students to: • Provide real or sample farm data for computation • Guide students to calculate mean, median, mode using calculators • Supervise students computing range and standard deviation • Use MS Excel for calculations 4.5 Assign group exercises using livestock datasets Review and	Calculators Data sheets with animal production records (weights, feed intake, etc.) Microsoft Excel or similar software Notebooks and Logbook

					correct students' calculations	
General Objective 5.0: Understand basic probability concepts in animal production						
8-9	5.1 Define probability and related terms. 5.2 Explain basic probability concepts in simple terms. 5.3 Discuss probability results for decision-making in animal production.	• Explain the concept of probability and key terms • Demonstrate simple probability calculations • Use examples from animal production (e.g., likelihood of disease, hatchability rate) • Solve sample problems on the board 5.5 Guide students through step-by-step calculations	Charts. Projector, whiteboard, Reference textbooks, internet	• Calculate simple probabilities using animal production examples. • Apply probability to real farm situations (e.g., disease occurrence, mortality rate).	Guide students to: • Provide real or simulated farm data (e.g., mortality records, hatch rates) • Calculate probabilities from datasets • Organize group exercises on farm-based scenarios • Demonstrate simple simulations (e.g., random selection, outcomes) • Supervise students applying probability to real-life farm cases • Review and correct students' work	Farm records (mortality rates, disease occurrence, hatchability data) Calculators Data sheets and recording materials Simple simulation tools (coins, dice, cards for demonstration) Microsoft Excel or similar software (optional)
General Objective 6.0: Know how to design and conduct simple field experiments						
10-11	6.1 Explain the purpose of field experiments in animal. production 6.2 Explain the	• Explain the concept and importance of field experiments • Introduce principles of experimental	Charts. Projector, whiteboard, Reference textbooks,	• Identify key principles of experimental design (randomization, replication, control).	• Demonstrate layout of a simple experiment (e.g., assigning treatments)	Farm animals (poultry, goats, rabbits, etc.) Feed materials (different feed types

	concept and importance of field experiments. 6.3 Explain steps in steps in designing an experiment.	design (randomization, replication, control) • Describe types of experimental designs (CRD, RCBD) • Demonstrate steps in designing an experiment • Use animal production examples (e.g., feed comparison trials) • Guide students in drafting simple experimental plans	internet	• Design a simple field experiment. • Develop a simple experimental layout (e.g., CRD or RCBD). • Conduct a basic field experiment (e.g., feed trial, growth comparison). • Record and manage data generated from the experiment.	• Supervise students in setting up experimental units (pens, plots, animals) • Guide students in conducting a simple experiment (e.g., feed trial) • Monitor data collection and recording by students • Assist students in identifying errors and correcting procedures • Facilitate group work in implementing experiments	for trials) Measuring tools (weighing scale, feed scoops) Record sheets/data collection forms Tags or markers for identification Stopwatch/timer (if required) Protective clothing (boots, gloves)
General Objective 7.0: Know how to analyze and interpret experimental results						
12-13	7.1 Explain the purpose of analyzing experimental data. 7.2 Explain simple methods of analysis (mean, comparison, basic ANOVA idea). 7.3 Explain how to interpret tables and	•Explain the concept of data analysis and interpretation •Introduce simple methods of analysis (mean, comparison, basic ANOVA idea) •Use examples from animal production (e.g., feed trial	Charts. Projector, whiteboard, Reference textbooks, internet	•Perform basic analysis (e.g., averages, comparisons, simple ANOVA concept). •Summarize experimental data using tables and simple statistics.	Guide students to: •Provide experimental data (e.g., feed trial, growth performance) •Guide students to compute summary statistics (mean, variation)	Experimental datasets (e.g., feed intake, weight gain records) Calculators Microsoft Excel or similar software (SPSS) Data recording sheets

	results.	results) • Demonstrate how to interpret tables and results • Guide students on drawing conclusions and making recommendations			•Supervise students in comparing treatment results •Demonstrate basic data analysis using calculators or Excel •Assist students in interpreting results and writing conclusions •Review and correct students' analysis and interpretations	Notebooks and writing materials
General Objective 8.0: Know the application of findings to improve animal production decisions						
14-15	8.1 Explain the concept of evidence-based decision-making in animal production. 8.2 Explain how experimental findings are used in animal production decisions. 8.3 Explain how research findings influence farm practices.	•Explain the concept of evidence-based decision-making in animal production •Demonstrate how research findings influence farm practices •Use case studies (e.g., feed trial results affecting ration formulation) •Guide students in interpreting results for decision-making •Facilitate class discussions on improving farm	Charts. Projector, whiteboard, Reference textbooks, internet	•Identify key results from animal production data. •Convert findings into practical farm actions Apply evidence-based decisions to improve productivity and efficiency in livestock systems.	Guide students to: • Provide experimental or farm data for analysis • Guide students in identifying key findings from results • Supervise group discussions on possible farm improvements • Demonstrate how to convert findings into practical farm actions • Assign students to	Experimental datasets (feed trials, growth performance, mortality records) Farm records and production logs Calculators Microsoft Excel or similar software (SPSS) Notebooks and worksheets

		performance using data •Ask questions to evaluate understanding			suggest improvements based on real datasets • Review and correct students' recommendations	
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% **Total: 100%**						

LIVESTOCK FARM MANAGEMENT

PROGRAMME: HIGHER NATIONAL DIPLOMA (HND) ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: LIVESTOCK FARM MANAGEMENT	**COURSE CODE: APT 323**	**CONTACT HOURS: 2 HOURS/WEEK**
	CREDIT UNIT: 2	**THEORETICAL: 2 HOURS/WEEK**
YEAR: I SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 0 HOURS/WEEK**
GOAL: This course is designed to equip students with knowledge and skills in the management of livestock, farm enterprises,		

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

1.0 Understand the concepts, principles of livestock farm management within the Nigerian agribusiness context.
2.0 Know strategic-planning frameworks to a livestock enterprise;
3.0 Understand principles of production economics and decision-making to livestock production;
4.0 Understand principles of financial management and investment appraisal;
5.0 Understand operations-management principles to a livestock enterprise;
6.0 Know risk-management frameworks and decision-making under uncertainty to livestock production;
7.0 Comprehend principles of marketing, value-chain analysis and agribusiness models to livestock products;
8.0 Understand principles of human-resource management to livestock-farm operations;
9.0 Know digital transformation, precision livestock farming, sustainability.

PROGRAMME: HIGHER NATIONAL DIPLOMA (HND) ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: LIVESTOCK FARM MANAGEMENT	COURSE CODE: APT 323	CONTACT HOURS: 2 HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: 2 HOURS/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 0 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL		
GOAL: This course is designed to equip students with knowledge and skills in the management of livestock, farm enterprises,		
GENERAL OBJECTIVE 1.0: Understand the concepts, principles of livestock farm management within the Nigerian agribusiness context.		

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Define farm management, livestock farm management, farm manager and agribusiness. 1.2 Explain the objectives of farm management. 1.3 Explain principles of management theory. 1.4 Outline the qualities and skills of a livestock farm manager (technical, conceptual, human,	• Explain farm-management terms. • Explain the objectives of farm management. • Discuss POSDCORB and the management process. • Discuss management theories. • Explain manager qualities and skills. • Explain types of enterprises. • Outline relationships with other animal	Whiteboard, markers, projector, charts. reference textbooks Internet			

	decision-making and digital literacy). 1.6 Describe types of livestock enterprises. 1.7 Outline the relationships between farm management and other animal sciences. 1.8 Explain challenges to livestock farm management in Nigeria.	sciences. • Discuss challenges in Nigeria.				
GENERAL OBJECTIVE 2.0: Know strategic-planning frameworks to a livestock enterprise						
2	2.1 Define strategic planning. 2.2 Describe the strategic-planning process. 2.3 Describe PESTLE, SWOT and Porter's Five Forces. 2.4 Describe the BCG matrix. 2.5 Describe the balanced scorecard. 2.6 Describe site selection. 2.7 Describe the farm business plan. 2.8 Describe the farm-layout master plan.	• Discuss strategic planning. • Describe the strategic-planning process. • Describe PESTLE, SWOT and Porter's Five Forces. • Describe the BCG matrix. • Discuss the balanced scorecard. • Explain site selection. • Describe the farm business plan. • Describe the farm-layout master plan.	Charts of strategy frameworks. Projector, whiteboard, sample business plans. Reference textbooks, internet.	•	•	
GENERAL OBJECTIVE 3.0: Understand principles of financial management and investment appraisal						

3-4	3.1 Define production economics. 3.2 Describe the law of diminishing marginal returns. 3.3 Describe input-output relationships in livestock production. 3.4 Describe the principle of equimarginal returns and resource allocation among enterprises. 3.5 Describe cost concepts. 3.6 Describe revenue concepts. 3.7 Describe profit maximisation (MR = MC). 3.8 Describe decision-making frameworks. 3.9 Describe partial budgeting, gross-margin analysis, enterprise budgeting and whole-farm budgeting. 3.10 Describe optimisation techniques.	• Explain production economics. • Discuss diminishing marginal returns. • Describe input-output relationships. • Describe Equi marginal returns. • Explain cost concepts. • Describe revenue and elasticity. • Describe profit maximisation. • Discuss production functions. • Describe decision-making frameworks. • Describe budgeting tools. • Discuss optimisation techniques.	Charts, projector, whiteboard, calculators. Sample budgeting spreadsheets. Reference, internet.	•		
GENERAL OBJECTIVE 4.0: Understand principles of financial management and investment						

5-6	4.1 Define farm finance. 4.2 Describe types of capital. 4.3 Describe sources of agricultural finance in Nigeria. 4.4 Describe financial statements. 4.5 Describe key financial ratios. 4.6Describe credit appraisal. 4.7 Describe loan amortisation and the debt-service coverage ratio. 4.8 Describe agricultural insurance.	•Explain farm finance. •Describe types and sources of capital. •Explain financial statements. •Explain financial ratios. •Describe time-value of money. •Discuss investment-appraisal techniques. •Describe credit appraisal. •Discuss loan amortisation. •Describe agricultural insurance.	Charts, projector, whiteboard, sample financial statements. Calculators, NAIC/NIRSAL brochures. Reference textbooks, internet.			
GENERAL OBJECTIVE 5.0: Understand operations-management principles to a livestock enterprise.						
7-8	5.1 Define operations management. 5.2 Describe production planning. 5.3 Describe capacity utilization. 5.4 Describe stocking density and carrying-capacity calculations. 5.5 Describe inventory management. 5.6 Describe supply-chain management.	• Discuss operations management. • Explain production planning. • Describe scheduling tools. • Explain capacity utilisation. • Describe stocking density. • Describe inventory management. • Explain quality management.	Charts, projector, whiteboard, EOQ calculator, reference textbooks, internet.			

		• Describe supply-chain management.				
GENERAL OBJECTIVE 6.0: Know risk-management frameworks and decision-making under uncertainty to livestock production						
9-10	6.1 Define risk and uncertainty. 6.2 Explain the differences between risk and uncertainty. 6.3 Describe categories of risk 6.4 Describe the risk-management process 6.5 Describe risk-assessment tools 6.6 Explain biosecurity as risk-mitigation; disease-outbreak preparedness. 6.7 Describe climate-risk management 6.8 Describe contingency and business-continuity planning.	• Explain risk and uncertainty. • Describe categories of risk. • Explain the risk-management process. • Describe risk-assessment tools. • Describe decision-making under uncertainty. • Describe risk-transfer mechanisms. • Explain biosecurity. • Describe climate-risk management. • Describe contingency planning.	Charts of risk frameworks. Projector, whiteboard, sample risk register. NAIC/NIRSAL brochures, reference textbooks, internet.			
GENERAL OBJECTIVE 7.0: Comprehend principles of marketing, value-chain analysis and agribusiness models to livestock products.						
11-12	7.1 Define marketing and the marketing mix. 7.2 Describe market structure. 7.3 Describe livestock	• Explain marketing and the marketing mix. • Describe market structure.	Charts, projector, whiteboard. Sample marketing			

	marketing channels. 7.4 Describe pricing strategies. 7.5 Describe the value chain. 7.6 Describe digital marketing. 7.7 Describe branding, packaging, labelling and certification. 7.8 Describe consumer behaviour and segmentation in livestock markets. 7.9 Describe agribusiness models. 7.10 Describe export of livestock products.	• Describe marketing channels. • Describe market intelligence. • Describe pricing strategies. • Describe the value chain. • Describe digital marketing. • Describe branding. • Describe consumer behaviour. • Describe agribusiness models. • Describe export.	materials, mobile devices. Reference textbooks			
GENERAL OBJECTIVE 8.0: Understand principles of human-resource management (HRM) to livestock-farm operations.						
13	8.1 Describe HRM. 8.2 Describe roles on a livestock farm. 8.3 Describe job analysis, job description and job specification. 8.4 Describe occupational health and safety on the livestock farm. 8.5 Describe communication and conflict resolution.	•Describe HRM functions. •Describe livestock-farm roles. •Describe job analysis. •Describe motivation theories. •Describe leadership styles. •Describe team-building. •Describe organisational structures.	Charts of HR theories. Projector, whiteboard, sample job descriptions. OHS posters, reference textbooks			

		•Describe OHS. •Describe communication and conflict resolution.				
GENERAL OBJECTIVE 9.0: Know digital transformation, precision livestock farming, sustainability.						
14-15	9.1 Define digital transformation in agriculture. 9.2 Describe big-data analytics, machine learning and AI applications in livestock. 9.3 Describe digital extension services. 9.4 Describe e-commerce and fintech for livestock. 9.5 Describe One Health and the manager's role in zoonotic-disease surveillance. 9.6 Discuss the future of livestock farm management in Nigeria.	• Explain digital transformation. • Describe precision livestock farming. • Describe farm-management software. • Describe big-data, ML and AI. • Describe blockchain. • Describe digital extension. • Describe e-commerce and fintech. • Describe One Health. • Discuss the future of livestock farm management.	Charts of PLF systems, projector, whiteboard. reference textbooks, internet, mobile devices.			
Course Assessment: Course work: 20% Test/Assignments: 20% Examination: 60% **Total: 100%**						

LIVESTOCK FARM PRACTICE II

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: LIVESTOCK FARM PRACTICE II	**COURSE CODE: APT 324**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 0**
YEAR: I SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 4 HOURS/WEEK**
GOAL: This course is designed to provide students with advanced hands-on competencies in the management of livestock enterprises		

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

1.0 Understand daily livestock farm operations and animal husbandry routines;
2.0 Apply reproductive management techniques including oestrus synchronisation, AI and pregnancy diagnosis;
3.0 Implement animal welfare, low-stress handling and modern biosecurity protocols on the farm;
4.0 Know neonatal and young-stock management across cattle, pigs and small ruminants;
5.0 Apply feedlot operations, body condition scoring and livestock finishing and marketing skills;
6.0 Use digital livestock farming tools including IoT sensors, RFID, GPS and farm management software;
7.0 Manage cold chain and product handling for meat, milk, eggs and vaccines;
8.0 Apply climate-smart livestock production practices on the farm.

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: LIVESTOCK FARM PRACTICE II	COURSE CODE: APT 324	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 0
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 4 HOURS/WEEK
COURSE SPECIFICATION: PRACTICAL		
GOAL: This course is designed to provide students with advanced hands-on competencies in the management of livestock enterprises		
GENERAL OBJECTIVE 1.0: Understand daily livestock farm operations and animal husbandry routines.		

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1-2				• Carry out morning and evening routine checks on all livestock units. • Perform measurement, recording and distribution of feed to cattle, pigs and poultry. • Carry out cleaning and disinfection of pens, feeders and waterers. • Attach ear tags and RFID tags to designated livestock. • Record identification data in farm management software. • Generate a herd or flock register for at least one species.	Guide students to: • Carry out morning and evening routine checks on all livestock units. • Measure, record and distribute feed to cattle, pigs and poultry.s • Clean and disinfect pens, feeders and waterers. • Attach ear tags and RFID tags to designated livestock. • Record identification data	Farm record book Weighing scales Disinfectants Brushes & scrapers Ear-tagging pliers RFID tags & reader Farm management app/laptop

					in farm management software. • Generate a herd/flock register for at least one species.	
General Objective 2.0: Apply reproductive management techniques including oestrus synchronization, AI and pregnancy diagnosis.						
3-4				• Record heat signs in cattle and small ruminants on the farm. • Complete an oestrus detection observation sheet for at least 5 animals. • Assist in insertion of CIDR device under supervision. • Thaw a semen straw. • Evaluate motility using a microscope and record findings. • Load AI gun and perform simulated AI on a dummy/phantom or restrained animal under supervision. • Carry out semen collection from a cockerel and inseminate a hen under supervision. • Observe pregnancy diagnosis via ultrasound	Guide students to: • Record heat signs in cattle and small ruminants on the farm. • Complete an oestrus detection observation sheet for at least 5 animals. • Assist in insertion of CIDR device under supervision. • Thaw a semen straw, evaluate motility using a microscope and record findings. • Load AI gun and perform simulated AI on a dummy/phantom or restrained animal under supervision.	Observation sheets CIDR devices Gloves Lubricant Tail chalk/paint AI gun & sheaths Liquid nitrogen tank Microscope & slides Semen straws Poultry AI tubes Gloves Ultrasound machine & probe Pregnancy record sheets Arm-length

				in at least 3 cattle, record gestational age. • Identify visual pregnancy signs in ewes/does and record expected kidding/lambing dates.	• Demonstrate semen collection from a cockerel and inseminate a hen under supervision	gloves Lubricant
General Objective 3.0: Implement animal welfare, low-stress handling and modern biosecurity protocols on the farm.						
5-6				• Conduct a welfare audit of the institutional farm using a five-domain checklist. • Apply low-stress cattle handling through a curved race or chute. • Restrain a pig, a sheep and a chicken using appropriate devices safely. • Draw a biosecurity zone map of the institutional farm. • Prepare a footbath solution at correct concentration and operate a knapsack sprayer. • Visit hatchery. • Sketch HVAC layout and identify clean/dirty zones.	Guide students to: • Conduct a welfare audit of the institutional farm using a five-domain checklist. • Apply low-stress cattle handling through a curved race or chute. • Safely restrain a pig, a sheep and a chicken using appropriate devices. • Draw a biosecurity zone map of the institutional farm. • Prepare a footbath solution at correct concentration and operate a knapsack sprayer. • Visit hatchery; sketch HVAC layout and identify clean/dirty zones.	Welfare audit checklist Head gate/chute Pig board Rope Poultry crate Disinfectant Knapsack sprayer Footbath tray Hatchery/poultry unit PPE

General Objective 4.0: Know neonatal and young-stock management across cattle, pigs and small ruminants.						
7-8				• Administer first-feed colostrum to a newborn calf, kid, or lamb within the first hour of birth. • Dip navel of neonates with 7% iodine solution. • Assess neonatal temperature and apply heat lamp or box for hypothermic animals. • Administer iron dextran injection (1 mL) to 3-day-old piglets. • Apply elastrator ring for piglet castration under supervision. • Assist in cross-fostering of piglets between sows. • Assist in supervised farrowing observation and recording.	Guide students to: • Administer first-feed colostrum to a newborn calf/kid/lamb within the first hour of birth. • Dip navel of neonates with 7% iodine solution. • Assess neonatal temperature and apply heat lamp/box for hypothermic animals. • Administer iron dextran injection (1 mL) to 3-day-old piglets. • Apply elastrator ring for piglet castration under supervision. • Assist in cross-fostering of piglets between sows. • Assist in supervised farrowing observation and recording.	Colostrum/milk replacer Calf tube feeder 7% iodine Thermometer Heat lamp Neonatal record sheet Iron dextran Syringes Elastrator & rings Farrowing record sheet Gloves Lubricant
General Objective 5.0: Apply feedlot operations, body condition scoring and livestock finishing and marketing skills.						

9-10				• Score BCS for at least 5 cattle, 5 sheep and 5 pigs on the institutional farm. • Weigh animals weekly and calculate ADG over a 2-week period. • Complete a feedlot entry selection form for 3 animals. • Calculate dressing percentage for a simulated slaughter data set. • Create a livestock marketing post on a social media platform (WhatsApp, Facebook etc). • Complete a break-even finishing-period worksheet for a 10-head feedlot.	Guide students to: • Score BCS for at least 5 cattle, 5 sheep and 5 pigs on the institutional farm. • Weigh animals weekly and calculate ADG over a 2-week period. • Complete a feedlot entry selection form for 3 animals. • Calculate dressing percentage for a simulated slaughter data set. • Create a livestock marketing post on a social media platform (WhatsApp/Facebook). • Complete a break-even finishing-period worksheet for a 10-head feedlot.	BCS reference cards Electronic weighbridge/ scale Feedlot log sheets Calculator Market data sheets Smartphone/ laptop Break-even worksheet Carcass data cards
General Objective 6.0: Use digital livestock farming tools including IoT sensors, RFID, GPS and farm management software.						
11-12				• Connect a temperature or humidity sensor to a farm monitoring app and record readings. • Scan RFID tags of at least	Guide students to: • Connect a temperature/humidity sensor to a farm monitoring app and	IoT sensor & app RFID reader Laptop with spreadsheet

				10 animals and export data to a spreadsheet. • Use farm management software to log feed deliveries and animal weights for one week. • Use an Excel least-cost template to formulate a broiler finisher ration meeting NRC requirement. • Formulate a dairy cow ration using the same template and compare costs.	record readings. • Scan RFID tags of at least 10 animals and export data to a spreadsheet. • Use farm management software to log feed deliveries and animal weights for one week. • Use an Excel least-cost template to formulate a broiler finisher ration meeting NRC requirement. • Formulate a dairy cow ration using the same template and compare costs.	Farm management software Laptops/computer lab Excel template NRC nutrient tables Ingredient prices
General Objective 7.0: Manage cold chain and product handling for meat, milk, eggs and vaccines.						
13-14				• Set up a temperature data-logger in the farm cold store or refrigerator. • Record readings every 2 hours for one day. • Carry out commercial egg fumigation, candling, grading and packaging. • Complete a cold-chain monitoring record for milk from collection to storage.	Guide students to: • Set up a temperature data-logger in the farm cold store/refrigerator and record readings every 2 hours for one day. • Carry out commercial egg fumigation,	Temperature data-logger Fumigation chamber Candler Egg grader Milk cans Cold store/refrigerator Cold box Ice packs

				• Prepare a cold box for vaccine transport, verify temperature and document chain-of-custody. • Perform CMT on at least 3 cows and record results; check milk SCC result sheet.	candling, grading and packaging. • Complete a cold-chain monitoring record for milk from collection to storage. • Prepare a cold box for vaccine transport, verify temperature and document chain-of-custody. • Perform CMT on at least 3 cows and record results; check milk SCC result sheet.	CMT paddle CMT reagent Vaccine record sheet Milk SCC record
General Objective 8.0: Apply climate-smart livestock production practices on the farm.						
15				• Measure temperature-humidity index (THI) on the farm for 3 days and classify heat-stress level. • Design a simple shade structure or sprinkler cooling system for a 50-head cattle unit (scale drawing). • Document at least 3 heat-tolerant livestock breeds on the farm/from pictures. • Visit the institutional biogas or compost facility. • Record input materials,	Guide students to: • Measure temperature-humidity index (THI) on the farm for 3 days and classify heat-stress level. • Design a simple shade structure or sprinkler cooling system for a 50-head cattle unit (scale drawing). • Document at least 3	Sling psychrometer/hygrometer Ruler & graph paper THI table Breed identification charts Biogas/compost facility Farm plan template Calculator Presentation

				retention time and output. • Develop a simple climate-smart farm management plan for a 10-hectare mixed livestock unit. • Present climate-smart farm plan to class (group exercise).	heat-tolerant livestock breeds on the farm/from pictures. • Visit the institutional biogas or compost facility; record input materials, retention time and output. • Develop a simple climate-smart farm management plan for a 10-hectare mixed livestock unit. • Present climate-smart farm plan to class (group exercise).	board/project or

Course Assessment

Course Assessment (Practical Based):	10%
Practical:	50%
Examination (Practical Based):	40%
Total:	**100%**

ANIMAL NUTRITION

PROGRAMME: HIGHER NATIONAL DIPLOMA (HND) ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: ANIMAL NUTRITION	**COURSE CODE: APT 325**	**CONTACT HOURS: 3 HOURS/WEEK**
	CREDIT UNIT: 3	**THEORETICAL: 1 HOUR/WEEK**
YEAR: I SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 2 HOURS/WEEK**
GOAL: This course is designed to equip students with the skills and principles for the practice of Animal Nutrition.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the importance of nutrition to animals; 2.0 Know the chemical composition of feed nutrients; 3.0 Understand the process of digestion in farm animals; 4.0 Understand the importance of water in nutrition; 5.0 Know the functions of carbohydrates, lipids and proteins to farm animals; 6.0 Understand the role of vitamins in nutrition and their deficiency symptoms; 7.0 Know the functions of minerals and their deficiency symptoms; 8.0 Know how to apply computer-aided feed formulation tools (Excel, Allix/AFOS) to least-cost ration formulation; 9.0. Know the value addition to crop residues and agro-industrial by-products as feed ingredients.		

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY						
COURSE TITLE: ANIMAL NUTRITION		**COURSE CODE: APT 325**		**CONTACT HOURS: 3 HOURS/WEEK**		
		CREDIT UNIT: 3		**THEORETICAL: 1 HOUR/WEEK**		
YEAR: I SEMESTER: II		**PRE-REQUISITE:**		**PRACTICAL: 2 HOURS/WEEK**		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the skills and principles for the practice of Animal Nutrition.						
GENERAL OBJECTIVE 1.0: Understand the importance of nutrition to animals						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Define nutrition and state its importance in farm animals. 1.2 Define nutrients and list the classes of nutrients in feed. 1.3 Outline the effects of climate on nutrition of animals.	• Explain nutrition and state its importance in farm animals. • Discuss nutrients and list the classes of nutrients in feed. • Discuss the effects of climate on nutrition of animals.	Whiteboard marker; charts; lecture notes. Projector Textbook	• Identify common feedstuffs and classify as roughage or concentrate.	Guide students to: • Identify common feedstuffs and classify as roughage or concentrate.	Feed Ingredients Gloves Facemask Boots
General Objective 2.0: Know the chemical composition of feed nutrients.						
2-3	2.1 List the chemical composition of protein, fat, carbohydrate, water and vitamins. 2.2 State the differences in chemical composition between nutrients. 2.3 Enumerate aromatic and aliphatic amino acids.	• Describe the chemical composition of protein, fat, carbohydrate, water and vitamins. • Explain the differences in chemical composition between nutrients. • Identify aromatic and aliphatic amino acids. • Describe the methods of proximate assay of	White lab tiles; pestle and mortar; glass ware; reagents.	• Perform qualitative tests for proteins, carbohydrate, fat and fibre on provided feed ingredients. • Carry out basic identification tests for proteins. • Carry out tests for carbohydrate, identification test	Guide students to: • Perform qualitative tests for proteins, carbohydrate, fat and fibre on provided feed samples. • Carry out basic identification tests for proteins. • Carry out tests for carbohydrate,	Laboratory equipment; reagents; feed ingredient.

	2.4 Describe the methods of proximate assay of feed Ingredients.	feed Ingredients.		for fat and identification test for fibre.	identification test for fat and identification test for fibre	
General Objective 3.0: Understand the process of digestion in farm animals.						
4-5	3.1 Describe the digestive tract of chicken, pig, cow, rabbit and snail. 3.2 Explain the differences between the digestive tracts listed in 3.1. 3.3 Describe the digestion of nutrients in a monogastric animal. 3.4 Describe digestion of nutrients in ruminants. 3.5 Describe the differences between the digestive tracts in monogastrics and ruminants. 3.6 Explain digestion in pseudoruminants (e.g. rabbit).	• Describe the digestive tract of chicken, pig, cow, rabbit and snail. • Explain the differences between the digestive tracts listed in 3.1. • Discuss the digestion of nutrients in a monogastric animal. • Discuss digestion of nutrients in ruminants. • Explain the differences between the digestive tracts in monogastrics and ruminants. • Discuss digestion in pseudoruminants (e.g. rabbit).	Charts of digestive tracts; slides; projector. Markers Flip chart	• Dissect digestive tracts of chicken and rabbit. • Identify tagged major organs. • Compare the digestive tracts (chicken, pig, cow, rabbit and snail)	Guide students to: • Dissect, identify and explain anatomical differences. • Use the GIT of large animals from the Abattoir to compare the differences of anatomical structures. • Compare the digestive tracts (chicken, pig, cow, rabbit and snail)	Dissection kits; or fresh samples from the abattoir
General Objective 4.0: Understand the importance of water in nutrition.						
6-7	4.1 Explain the properties of water. 4.2 State the general	• Describe the properties of water. • State the general	Whiteboard Markers Charts	• Monitor water intake of broilers, layers and rabbits	Guide students to: • Monitor water intake of broilers,	Water troughs, measuring jugs, data recording

	importance of water in farm animals. 4.3 Explain the factors affecting water intake and excretion. 4.4 List the sources of water to farm animals.	importance of water in farm animals. • Describe the factors affecting water intake and excretion. • Discuss the sources of water to farm animals.	Internet	under different temperature conditions. • Record data of water intake.	layers and rabbits under different temperature conditions, record data. • Monitor water intake in relation to nature of feed	sheets.
General Objective 5.0: Know the functions of carbohydrates, lipids and proteins in farm animals						
8-9	5.1 List common sources of carbohydrates, lipids and proteins. 5.2 Explain differences in efficiency of utilisation of carbohydrate and protein sources by monogastrics vs ruminants. 5.3 State the functions of protein, carbohydrates and lipids in production of farm animals. 5.4 List the deficiency symptoms of each of the nutrients.	• Explain common sources of carbohydrates, lipids and proteins. • Discuss differences in efficiency of utilisation of carbohydrate and protein sources by monogastrics vs ruminants. • Explain the functions of protein, carbohydrates and lipids in production of farm animals. • Explain the deficiency symptoms of each of the nutrients listed above.	Slides, projector, photographs, charts. Markers Internet Lecture notes	• Identify sources of ingredients for feed formulation of a simple protein/energy (balanced ration). • Identify deficiency of nutrient in feed ingredients e.g soft shell egg, calcium deficiency. • Analyse feed ingredients.	Guide students to: • Identify sources of ingredients for feed formulation of a simple protein/energy (balanced ration) • Identify deficiency of nutrient in feed ingredients e.g soft shell egg, calcium deficiency • Analyse feed ingredients	Nutritive value tables worksheets calculator, Feed ingredients
General Objective 6.0 Understand the role of vitamins in nutrition and their deficiency symptoms.						
10-11	6.1 Define vitamins. 6.2 Classify vitamins. 6.3 List the vitamins in each class.	• Discuss the role of vitamins in animal nutrition. • Explain the vitamins in	Whiteboard, Markers charts Lecture	• Examine photographic case studies of vitamin deficiency signs in	Guide students to: • Examine photographic case studies of vitamin	Photographic charts, reference materials, Animals on the

	6.4 State the sources, physiological functions and deficiency symptoms of each vitamin.	each class. • Explain the physiological functions and deficiency symptoms of each vitamin.	notes Internet Chart for nutrient deficiencies reference textbooks.	poultry and ruminants. • Record observations. • Examine deficiency cases on the farm e.g rickets, softshell egg.	deficiency signs in poultry and ruminants, record observations • Examine deficiency cases on the farm e.g rickets, softshell egg	farm. X-ray films
General Objective 7.0: Know the functions of minerals and their deficiency symptoms						
12-13	7.1 Explain minerals into macro and micro elements. 7.2 Explain sources, functions and deficiency symptoms of minerals in farm animals. 7.3 Explain the effects of levels of some minerals on the absorption and excretion of others (interaction).	• Explain the classification of minerals into macro and micro elements. • Discuss the sources, functions and deficiency symptoms of minerals in farm animals. • Describe the effects of levels of some minerals on the absorption and excretion of others (interaction).	Charts, Whiteboard Markers internet	• Identify mineral premix supplements. • Calculate mineral inclusion levels in a poultry ration. • Identify deficiency symptoms of minerals in farm animals.	Guide students to; • Identify and handle mineral premix supplements, calculate mineral inclusion levels in a poultry ration. • Identify deficiency symptoms of minerals in farm animals.	Mineral premix samples, nutritive value tables calculator Animals on the farm.
General Objective 8.0: Know how to apply computer-aided feed formulation tools (Excel, Allix/AFOS) to least-cost ration formulation.						
14	8.1 Define computer-aided feed formulation. 8.2 Identify feed formulation software packages. 8.3 Describe software output.	• Discuss computer-aided feed formulation and concept of least-cost ration. • Explain feed formulation software packages: Allix, AFOS, Best Mix and	Charts, Whiteboard Markers internet	• Use Excel or Allix to formulate a least-cost broiler finisher ration meeting NRC standards, compare with manual method.	Guide students to: • Use Excel or Allix to formulate a least-cost broiler finisher ration meeting NRC standards; compare with manual	Computers Excel feed formulation template or Allix demo printer, ingredient cost data.

	8.4 Explain quality control and validation of computer-generated rations.	Microsoft Excel. • Discuss software output: nutrient summary, cost per ton, ingredient inclusion levels. • Explain quality control and validation of computer-generated rations.		• Compare manual Pearson Square results with computer-generated outputs. • Describe the steps for entering ingredients, nutrient profiles and animal requirements into software.	method. • Compare manual Pearson Square results with computer-generated outputs. • Describe the steps for entering ingredients, nutrient profiles and animal requirements into software.	
General Objective 9.0: Know the value addition to crop residues and agro-industrial by-products as feed ingredients						
15	9.1 Define agro-industrial by-products and its common sources. 9.2 Explain urea treatment of crop straws to improve digestibility. 9.3 Discuss production of molasses-urea blocks. 9.4 Explain silage making from crop residues. 9.5 Enumerate cost–benefit analysis of by-product utilisation vs conventional ingredients.	• Explain agro-industrial by-products and its common sources (brewers' dried grains, palm kernel cake, rice bran, wheat offal, etc.). • Describe urea treatment of crop straws to improve digestibility. • Explain production of molasses-urea blocks. • Describe silage making from crop residues. • Conduct cost–benefit analysis of by-product utilisation vs conventional ingredients.	Charts, Whiteboard Markers internet	• Prepare urea-treated maize stover. • Prepare molasses treated maize stalks/stover. • Evaluate quality and compute cost per unit nutrient.	Guide students to: • Prepare urea-treated maize stover • Prepare molasses treated maize stalks/stover • Evaluate quality and compute cost per unit nutrient	Maize stover, Maize stalk, urea, molasses, lime stone, mineral premix, bucket, Scale, pH meter.

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

SHEEP AND GOAT PRODUCTION

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: SHEEP AND GOAT PRODUCTION	**COURSE CODE: APT 326**	**CONTACT HOURS: 3 HOURS/WEEK**
	CREDIT UNIT:3	**THEORETICAL: 1 HOUR/WEEK**
YEAR: 1 SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 2 HOURS/WEEK**
GOAL: This course is designed to provide students with the knowledge and skills for sheep and goat production		

GENERAL OBJECTIVES: On completion of this course, the students should be able to:
1.1Know the important breeds of Sheep and Goat and their characteristics;
2.0 Know the types of Housing and equipment required for sheep and goat rearing;
3.0 Understand the management of adult sheep and Goat;
4.0 Know the care and management of female during gestation and parturition and of the young;
5.0 Understand Nutrition in Sheep and Goats;
6.0 Understand the importance of improvement of animals through breeding and selection;
7.0 Understand health and disease problems in sheep and goats.

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: SHEEP AND GOAT PRODUCTION	COURSE CODE: APT 326	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT:3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: This course is designed to provide students with the knowledge and skills for sheep and goat production		
GENERAL OBJECTIVE 1.0: Know the important breeds of Sheep and Goat and their characteristics.		

	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 external features of typical sheep and goats. 1.2 Discuss the various breeds of sheep and goats in Nigeria and their characteristics. 1.3 Describe the distribution and adaption of sheep and goats in Nigeria. 1.4 Classify sheep and goats into meat type, milk type and dual purpose. 1.5 Explain the economic importance of sheep and goat in Nigeria.	• Explain the external features of typical sheep and Goats • Explain the major sheep and goat breeds in Nigeria and their peculiar characteristics • List the indigenous sheep and goat breeds, their distribution in Nigeria ecological zones and their adaptive features • Explain meat type, dairy and dual-purpose breeds of sheep and goats in Nigeria • Explain the economic importance of sheep and goats to national economy	Charts, Whiteboard Markers internet	• Identify sheep and goat breeds on farm. • Draw a well labelled diagram showing the distribution of sheep and goat breeds among the ecological zones of Nigeria. • Classify sheep and goat breeds in Nigeria according to product or products derived from them (milk, meat or both). • Assess the importance of rearing sheep and goat and its contribution to national economy.	Guide students to • Identify sheep and goat breeds live on farm or on chart • Draw a well labelled diagram showing the distribution of sheep and goat breeds among the ecological zones of Nigeria. • Classify sheep and goat breeds in Nigeria according to product or products derived from them (milk, meat or both)	Charts and slides of different sheep and goat breeds and different housing types. Regular farm visits Sheep and Goat houses Feed troughs Water troughs

General Objective 2.0: Know the types of housing and equipment required for sheep and goat rearing.						
3-4	2.1 List the factors influencing the location of sheep and Goat houses. 2.2 Describe the design of sheep and goat houses. 2.3 Relate the design of the houses to climatic conditions 2.4 State the space requirement for different classes of sheep and goat 2.5 List the equipment needed for rearing of sheep and goat.	• Explain the factors influencing the location of sheep and Goat houses. • Describe the design of sheep and goat houses. • Describe the types of housing and equipment required for sheep and goat rearing • Explain factors of consideration in location of sheep and goat house • Design a simple sheep and goat house with adequate floor spacing requirement for different classes	Charts, Whiteboard Markers internet	• Sketch different housing types for sheep and goats. • Identify various rearing equipment for sheep and goats. • Enumerate factors influencing location of sheep and goat building.	Guide students to • Sketch different types of suitable houses for sheep and goats. • Visit existing sheep and goat houses on the school farm • Assist the student in the identification of relevant equipment on the farm.	Sheep and Goat houses Feed troughs Water troughs
General Objective 3.0: Understand the management of adult sheep and goat.						
5-6	3.1 Explain the importance of procurement of stock from reliable source and quarantine the new stock. 3.2 Describe the major systems of sheep and goat management (extensive, semi-intensive and intensive). 3.3 State the importance of	• Insist new animals in the school farm are duly quarantined and purchased from a reliable source. • State the advantages and disadvantages of the different sheep and goat management systems • Ensure the school farm is well ventilated and observe strict sanitation protocol.	Charts, Whiteboard Markers internet	• Carry out routine management practices like such as cleaning, feeding and washing of pens. • Identify the advantages and disadvantages of the different sheep and goat management systems. • Inspect the ventilation	Guide students to • Participate in routine management practices like – cleaning, feeding and washing of pens. • Observe strict sanitation protocol in the farm	Sheep and Goat houses Feed troughs Water troughs

	good sanitation ventilation and exercise in the management of sheep and goat. 3.4 Describe the various methods of identification in sheep and goat. 3.5 Describe the parasites control in sheep and goats. 3.6 Explain the principles of farm record keeping.	• Demonstrate tagging using sheep and goats on the school farm • Display basic drugs used for control of external and internal parasites in sheep and goats • Explain the importance and relevance of farm records.		and sanitation of the school farm. • Tagg sheep and goats on school farm under supervision.	• Demonstrate tagging of sheep and goats in the school farm • Recognize the merit and demerit of different management systems • Identify the importance and relevance of farm records. •	
General Objective 4.0: Know the care and management of female during gestation and parturition and of the young.						
7-8	4.1 Identify gestation period for ewes and their care during gestation. 4.2 Explain steaming up in does and ewes. 4.3 Describe how to prepare for lambing/kidding. 4.4 Identify the signs of onset of birth and the common problems encountered during parturition. 4.5 Explain the importance of post parturition management. 4.6 Describe the care of the young with their mothers before weaning.	• Discuss gestation periods for sheep and goats • Explain steaming up in pregnant does and ewes and preparation for parturition • Discuss signs of parturition and common problems encountered during lamb/kid delivery • Discuss the importance and relevance of post parturition practices i) ➢ Treatment of Navel with iodine ➢ Feeding on colostrum ➢ Fostering ➢ Creep feeding ➢ Creep grazing	Charts, Whiteboard Markers internet	• Participate in steaming up exercise. • Identify signs of parturition in doe/ewe. • Identify common problems encountered during lambing /kidding. • Perform castration using the Burdizo or elastrator method under supervision.	Guide students to • Demonstrate steaming up exercise • Recognize signs of parturition in doe/ewe • Witness common problems encountered during lambing /kidding • Witness castration using the Burdizo or elastrator method	On farm demonstration of steaming up Photo image of a doe/ewe pre parturition and Dystocia in doe/ewe Sheep and Goat houses Feed

	4.7 Explain the reasons and methods of castration in sheep and goats. 4.8 Explain the processes of weaning of lamb/kid.	• Explain care and management of does and ewes during gestation, parturition and lactation • Discuss management of the lambs and kids • Describe various methods of castration in sheep and goats as well as weaning of lambs and kids				troughs Water troughs demonstration of Burdizo or Elastrator castration
General Objective 5.0: Understand Nutrition in Sheep and Goats.						
9-10	5.1 Describe the digestive system of sheep and goats. 5.2 List the various types of grasses and forages used for sheep and goat feeding. 5.3 State the nutrients requirements of sheep and goats and their daily meal and water allowance. 5.4 Explain grazing and grazing systems like: Zero grazing; Rotational grazing etc. 5.5 Identify the symptoms of some nutritional disease of sheep and goats.	• Discuss the importance of rumen, reticulum and omasum in the ruminant digestive system • Explain the importance and relevance of grasses, legumes, browse plants, conserved forages, farm residues, shrubs, roughages in the nutrition of sheep and goats • Discuss nutrient requirements in sheep and goats and daily water intake • Discuss grazing and grazing systems • Describe metabolic diseases of sheep and goats and their symptoms	Charts, Whiteboard Markers internet	• Recognize rumen, reticulum and omasum as parts of the ruminant stomach. • Identify forage-based feedstuffs of nutritional importance. • Identify nutrients and water requirements of sheep and goats. • Carry out grazing of sheep and goats. • Recognize basic symptoms of some metabolic diseases of sheep and goats.	Guide students to • Draw illustrated diagram of ruminant stomach showing rumen, reticulum and omasum • Prepare a herbarium containing samples of forage-based feedstuffs of nutritional importance • Identify grazing and grazing systems in ruminant nutrition • Recognize basic symptoms of some metabolic diseases of sheep and goats	Sheep and Goat houses Feed troughs Water troughs
General Objective 6.0: Understand the importance of improvement of animals through breeding and selection.						

11-12	6.1 Explain the factors considered in selection of livestock. 6.2 Describe desirable characteristics or conformation of male and female sheep and goats for breeding. 6.3 Explain the effects of pre-breeding, in breeding and cross breeding on performance of sheep and goats. 6.4 Explain the following: a. Age at puberty; b. Oestrus cycle; c. Signs of heat; d. Photoperiodism in breeding; e. Age at first service; f. Mating methods; g. Mating ratios. 6.5 State the importance of flushing in sheep and goats. 6.6 Explain lambing percentage and pseudo-pregnancy in goats.	• Discuss kinds of selection and factors that influence selection in farm animals • Highlight the desirable traits for a breeder doe and ewe • Discuss the effects of inbreeding and cross breeding in sheep and goats • Explain the following ➢ Oestrus cycle ➢ Signs of heat ➢ Photoperiodism in breeding ➢ Age at first service ➢ Mating methods ➢ Mating ratios • Explain the importance of flushing in sheep and goats • Discuss lambing percentage and pseudo-pregnancy in goats	Charts, Whiteboard Markers internet	• Identify qualities of a good breeder doe/ewe. • Identify basic terminologies associated with breeding in sheep and goats. • Carry out flushing of sheep and goat to show the effects. • Identify sheep and goat with desirable and undesirable conformation on the school farm.	Guide students to • Identify qualities of a good breeder doe/ewe • Identify basic terminologies associated with breeding in sheep and goats • Carry out flushing of sheep and goat to show the effects • Show examples of sheep and goat with desirable/undesirable conformation on the school farm	Sheep and Goat houses Feed troughs Water troughs
General Objective 7.0: Understand health and disease problems in sheep and goats						
13-15	7.1 List signs of ill health in sheep and goat. 7.2 List the common diseases in sheep and	• Discuss signs and symptoms of illness in sheep and goats • Explain common diseases	Charts, Whiteboard Markers internet	• Identify sick animals from symptoms. • Recognize peculiar symptoms of common	Guide students to • Identify sick animals from symptoms	Sheep and Goat houses Feed

	goat. 7.3 Identify the symptoms and control of these diseases.	of sheep and goats and their peculiar symptoms • Discuss preemptive and prophylactic treatments to forestall disease outbreak in farms		diseases of sheep and goats. • Demonstrate knowledge of preemptive and prophylactic treatments to forestall disease outbreak in farms.	• Identify peculiar symptoms of common diseases of sheep and goats • Demonstrate preemptive and prophylactic treatments to forestall disease outbreak in farms	troughs Water troughs

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

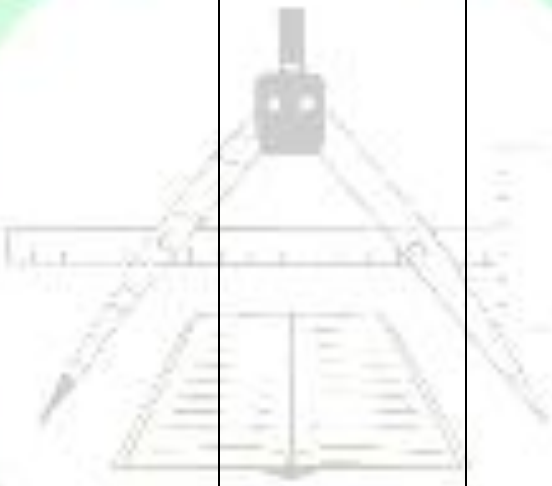
MINI LIVESTOCK PRODUCTION

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: MINI LIVESTOCK PRODUCTION	**COURSE CODE: APT 327**	**CONTACT HOURS: 3 HOURS/WEEK**
	CREDIT UNIT: 3	**THEORETICAL: 1 HOUR/WEEK**
YEAR: I SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 2 HOURS/WEEK**
GOAL: The course is designed to provide students with the knowledge and skills for production of mini-livestock.		

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

1.0 Know the important species of animals regarded as mini-livestock;
2.0 Know the type of Housing and Equipment required for mini-livestock production;
3.0 Understand the Nutrition and Feeding of Mini-Livestock;
4.0 Understand Reproduction and breeding of mini-livestock;
5.0 Understand the routine management practices for different species of mini-livestock;
6.0 Know the establishment and management of commercial Black Soldier Fly larvae and alternative-protein production;
7.0 Know the common diseases of mini-livestock animals and their control.

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY					
COURSE TITLE: MINI LIVESTOCK PRODUCTION		**COURSE CODE: APT 327**		**CONTACT HOURS: 3 HOURS/WEEK**	
		CREDIT UNIT: 3		**THEORETICAL: 1 HOUR/WEEK**	
YEAR: I SEMESTER: I		**PRE-REQUISITE:**		**PRACTICAL: 2 HOURS/WEEK**	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL					
GOAL: The course is designed to provide students with the knowledge and skills for production of mini-livestock					
GENERAL OBJECTIVE 1.0: Know the important species of animals regarded as mini-livestock Production					
THEORETICAL CONTENT				**PRACTICAL CONTENT**	
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Define the term mini livestock. 1.2 Explain the various breeds/species. 1.3 Explain the importance of rearing these species of animals. 1.4 Describe the distribution of the animals their adaptive features and localities.	• Explain what is meant by mini livestock • Describe the various breeds/species/varieties of ➢ Edible land snail ➢ Grass cutter/cane rat ➢ Giant bush rat ➢ Guinea pigs • Discuss the importance of rearing these animal species • Explain the distribution, locations and adaptive features of these animal species.	Charts, Whiteboard Markers internet	• Identify of these animal species on farm. • Identify the importance of rearing these animal species. • Carry out distribution, location and adaptive features of edible land snail, grass cutter/cane rat and Guinea pig).	Guide students to • Identify of these animal species on farm • Identify the importance of rearing these animal species • Carry out distribution, location and adaptive features of edible land snail, grass cutter/cane rat and Guinea pig).	Live mini-livestock animals (rabbits, grasscutters, snails, quails, guinea pigs, etc.) Animal housing units such as cages, pens, hutches, and snaileries Feed ingredients and formulated feeds Feeders and drinkers Personal

						Protective Equipment (PPE) such as gloves, boots, nose masks, and overalls wheelbarrows, shovels, rakes, and hand trowels Weighing scale Veterinary first aid materials and basic medications Record books, notebooks, and farm record sheets Charts, posters,
General Objective 2.0: Know the type of Housing and Equipment required for Mini-livestock Production.						
2-4	2.1 Describe the design of housing for each type of mini livestock. 2.2 Relate the design of houses to climatic conditions and peculiarities of the	• Exhibit diagrammatic design of peculiar housing type for each of these animal species • Tag the uniqueness of each house design to	Charts, Whiteboard Markers internet	• Carry out housing design for Mini - livestock species both in the school farm and on a chart. • Identify rearing equipment for the	Guide students to • Carry out housing design for Mini - livestock species both in	Feeders Waterers Troughs Buckets House design charts

	animals. 2.3 Explain i. stocking, ii. foundation stock iii. procurement, iv. stocking density v. Space requirement for each species. 2.4 List the equipment needed for rearing each species.	climatic requirement of each specie • Explain stocking, ➢ foundation stock ➢ procurement, ➢ stocking density ➢ Space requirement for each species. • Itemize rearing equipment for each animal species		various Mini – livestock.	the school farm and on a chart. • Identify rearing equipment for the various Mini – livestock species	
General Objective 3.0: Understand the Nutrition and Feeding of Mini-Livestock						
5	3.1 Describe the digestive system of snail. 3.2 List the various feeding resources used for mini livestock. 3.3 State the nutritional requirements of various Mini-livestock species and daily feed and water intake. 3.4 Discuss the symptoms of nutritional diseases in mini livestock.	• Discuss the digestive System of Snail • Identify feeds and feed resources for Mini-livestock species • Explain the nutritional requirements as well as daily feed and water intakes for the various Mini-livestock species • Describe diseases and nutritional deficiency symptoms in Mini livestock	Charts, Whiteboard Markers internet	• Formulate feeds for different Mini-livestock species. • Identify samples of compounded feed and feedstuffs. • Calculate feed and water intake in ini-livestock nutrition. • Adopt preventive approach in healthcare management of Mini livestock.	Guide students to • Formulate feeds for different mini-livestock species • Identify samples of compounded feed and feedstuffs. • Calculate feed and water intake in Mini-livestock nutrition. • Adopt preventive approach in healthcare	Samples of feed and feed Ingredients Mimeographs and briefs on Mini-livestock Production

					management of Mini livestock	
General Objective 4.0: Understand Reproduction and Breeding of Mini-livestock						
6 - 9	4.1 Explain the reproductivity in Mini-livestock. 4.2 Discuss mating procedures in each type of Mini-livestock. 4.3 Describe gestation in Mini-livestock with reference to care for the females. 4.4 Describe egg laying and incubation in snail rearing. 4.5 Explain care for young ones after parturition/hatching. 4.6 Explain i. pure breeding ii. in-breeding iii. cross breeding iv. cross-mating v. breeding methods in Snails	• Discuss reproduction in Mini-livestock • Explain mating systems for each Mini-livestock species • Discuss factors influencing gestation periods in female animals • Explain incubation and egg laying in Snails • Discuss care and management of kits/hatchlings post parturition • Explain ➢ pure breeding ➢ in-breeding ➢ cross breeding ➢ cross-mating ➢ breeding methods in Snails	Charts, Whiteboard Markers internet	• Identify the reproductive organs of common mini-livestock species. • Demonstrate proper handling and restraint of mini-livestock during breeding activities. • Identify signs of heat and mating behaviour in mini-livestock. • Inspect male and female mini-livestock used for breeding purposes and their differences. • Demonstrate proper selection of healthy breeding stock based on physical characteristics. • Carry out simple record keeping for breeding and reproduction activities. • Demonstrate proper	Guide students to: • Identify the reproductive organs of common mini-livestock species. • Demonstrate proper handling and restraint of mini-livestock during breeding activities. • Identify signs of heat and mating behaviour in mini-livestock. • Differentiate male and female mini-livestock used for breeding	Live mini-livestock animals (rabbits, grasscutters, snails, quails, guinea pigs, etc.) Animal housing units such as cages, pens, hutches, and snaileries Feed ingredients and formulated feeds Feeders and drinkers Personal Protective Equipment (PPE) such as gloves, boots, nose masks, and overalls

				care and management of pregnant mini-livestock. • Identify equipment and materials used in breeding management. • Report stages of reproduction and offspring development in mini-livestock. • Practice sanitation and biosecurity measures during breeding and reproduction operations.	purposes. • Demonstrate proper selection of healthy breeding stock based on physical characteristics . • Carry out simple record keeping for breeding and reproduction activities. • Demonstrate proper care and management of pregnant mini-livestock. • Identify equipment and materials used in breeding management. • Report stages of reproduction	wheelbarrows, shovels, rakes, and hand trowels Weighing scale Veterinary first aid materials and basic medications Record books, notebooks, and farm record sheets Charts, posters,

					and offspring development in mini-livestock. • Practice sanitation and biosecurity measures during breeding and reproduction operations.	
General Objective 5.0: Understand the Routine Management for Different Species of Mini-Livestock						
10-12	5.1 Discuss routine management practices in Mini livestock production 5.2 Describe identification methods for various mini-livestock species 5.3 Explain handling of various classes of Mini-livestock species 5.4 State the Importance of good sanitary measures in a Mini-livestock enterprise 5.5 Explain methods of identifying various Mini-livestock species	• Explain the routine management practices necessary in Mini livestock enterprise • Explain methods of identifying various Mini-livestock species • Explain the methods of handling of various classes of Mini-livestock species • Describe the Importance of good sanitary measures in a Mini-livestock enterprise	Charts, Whiteboard Markers internet	• Demonstrate proper handling techniques for different species of mini-livestock. • Carry out routine feeding and watering of mini-livestock. • Perform daily cleaning and sanitation of mini-livestock housing units. • Identify common signs of ill-health and stress in mini-livestock. • Demonstrate proper grooming and care practices for mini-livestock species. • Maintain simple	Guide students to: • Demonstrate proper handling techniques for different species of mini-livestock. • Carry out routine feeding and watering of mini-livestock. • Perform daily cleaning and sanitation of	Live mini-livestock animals (rabbits, grasscutters, snails, quails, guinea pigs, etc.) Animal housing units such as cages, pens, hutches, and snaileries Feed ingredients and formulated feeds

				records of feeding, growth, and health management. • Apply biosecurity and safety measures during routine management activities.	mini-livestock housing units. • Identify common signs of ill-health and stress in mini-livestock. • Demonstrate proper grooming and care practices for mini-livestock species. • Maintain simple records of feeding, growth, and health management. • Apply biosecurity and safety measures during routine management activities.	Feeders and drinkers Personal Protective Equipment (PPE) such as gloves, boots, nose masks, and overalls wheelbarrows, shovels, rakes, and hand trowels Weighing scale Veterinary first aid materials and basic medications Record books, notebooks, and farm record sheets Charts, posters,
General Objective 6.0: Know the establishment and management of commercial Black Soldier Fly larvae and alternative-protein production						
13-14	6.1 Describe the commercial Black Soldier Fly (BSF).	• Describe commercial BSF life cycle.	Charts, Whiteboard	• Establish a commercial-grade BSF	Guide students to:	BSF starter colony,

	6.2 Outline the BSF business case. 6.3 Describe commercial BSF facilities. 6.4 Explain organic waste-stream specifications. 6.5 Discuss FAO Insects for Food and Feed (2021) framework and Nigerian NAFDAC approval pathway. 6.6 Describe BSF post-harvest processing. 6.7 Explain quality-control and shelf-life. 6.8 Outline BSF-meal inclusion rates. 6.9 Describe other alternative proteins. 6.10 Discuss commercial economics.	• Outline BSF business case. • Describe commercial facilities. • Explain waste-stream specifications. • Discuss FAO/NAFDAC frameworks • Describe BSF processing methods. • Explain quality-control and shelf-life. • Outline inclusion rates by species. • Describe other alternative proteins. • Discuss commercial economics.	Markers internet	demonstration unit (10–50 kg larvae weekly capacity). • Operate a love-cage, nursery and grow-out system through one production cycle. • Manage organic waste-stream inputs from multiple sources. • Establish a commercial-grade BSF demonstration unit (10–50 kg larvae weekly capacity). • Operate a love-cage, nursery and grow-out system through one production cycle. • Manage organic waste-stream inputs from multiple sources.	Establish commercial BSF unit. • Operate one full production-cycle. • Manage waste-stream input • Establish BSF post-harvest processing. • Operate LFA aflatoxin testing. • Operate feed formulation with BSF. • Manage cost-benefit calculation	Love-cage, nursery and grow-out infrastructure, Waste-stream inputs, PPE, BSF post-harvest equipment, LFA aflatoxin kits, Feed-formulation worksheets/software, Nigerian feed-ingredient price list
General Objective 7.0: Know the Common Diseases and Parasites of Mini-Livestock Species and their Control						
15	7.1 List the common diseases and parasites of the various categories of mini livestock. 7.2 Explain the symptoms and control measures for these diseases/parasites.	• Highlight common diseases and parasites of various categories of Mini-livestock. • Discuss the symptoms and control measures of these diseases and	Charts, Whiteboard Markers internet	• Identify common diseases of rabbits, grasscutters, snails, guinea pigs, and quails. • Identify common parasites such as ticks, lice, mites, fleas, and	Guide student to: • Identify common diseases of rabbits, grasscutters, snails, guinea	Live mini-livestock species). Charts Posters showing common

	7.3 Describe some preventive measures against diseases/parasites.	parasites • Prescribe some preventive measures against these diseases and parasites		intestinal worms. • Demonstrate proper animal handling and restraint techniques. • Observe clinical signs including loss of appetite, weakness, diarrhea, coughing, and skin lesions. • Clean animal houses and equipment. • Demonstrate quarantine and isolation procedures for sick animals. • Practice application of biosecurity measures in mini-livestock farms. • Demonstrate the administration of dewormers and ectoparasite control measures. • Record keeping of animal health status and treatments.	pigs, and quails. • Identify common parasites such as ticks, lice, mites, fleas, and intestinal worms. • Demonstrate proper animal handling and restraint techniques. • Observe clinical signs including loss of appetite, weakness, diarrhea, coughing, and skin lesions. • Clean animal houses and equipment. • Demonstrate quarantine and isolation procedures for sick animals. • Practice application of biosecurity measures in	diseases and parasites. Veterinary manuals and animal health textbooks. Personal Protective Equipment (PPE) Disinfectants, antiseptics, and sanitation materials. Deworming and antiparasitic drugs. Syringes and basic veterinary first aid materials. Animal cages, pens, feeders, and drinkers. Audio-visual materials including videos and

					mini-livestock farms. • Demonstrate the administration of dewormers and ectoparasite control measures. Record keeping of animal health status and treatments.	slides on disease control. Farm record books and observation sheets. Veterinary clinic or teaching farm facilities.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% **Total: 100%**						

APICULTURE AND HIVE PRODUCTS

PROGRAMME: HIGHER NATIONAL DIPLOMA (HND) ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: APICULTURE AND HIVE PRODUCTS	**COURSE CODE: APT 328**	**CONTACT HOURS: 3 HOURS/WEEK**
	CREDIT UNIT: 3	**THEORETICAL: 1 HOUR/WEEK**
YEAR: I SEMESTER: II	**PRE-REQUISITE**	**PRACTICAL: 2 HOURS/WEEK**
GOAL: This course is designed to equip students with comprehensive knowledge and practical skills in apiculture hive products		

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

1.0 Understand the scope, economic, ecological and One-Health importance of apiculture in Nigeria and globally;
2.0 Understand bee biology, the structure of a honey-bee colony, the three castes, the bee life cycle and colony communication;
3.0 Understand major honey-bee species and tropical races in Nigeria;
4.0 Understand the set-up of an apiary with appropriate equipment and facilities;
5.0 Know the management of honey-bee colonies using standard practices;
6.0 Comprehend bee forage resources and pollination services effectively;
7.0 Know pests **c**ontrol, predators, and diseases of bees using appropriate methods;
8.0 Know the process and value-add hive products to ensure quality;
9.0 Know the application of marketing, regulatory standards and entrepreneurial skills in apiculture production.

PROGRAMME: HIGHER NATIONAL DIPLOMA (HND) ANIMAL PRODUCTION TECHNOLOGY						
COURSE TITLE: APICULTURE AND HIVE PRODUCTS		**COURSE CODE: APT 328**		**CONTACT HOURS: 3 HOURS/WEEK**		
		CREDIT UNIT: 3		**THEORETICAL: 1 HOUR/WEEK**		
YEAR: I SEMESTER: II		**PRE-REQUISITE**		**PRACTICAL: 2 HOURS/WEEK**		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in apiculture hive products						
GENERAL OBJECTIVE 1.0: Understand the scope, economic, ecological and One-Health importance of apiculture in Nigeria and globally.						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Define apiculture and related terms. 1.2 Outline the history of beekeeping in Africa and Nigeria. 1.3 State the economic importance of apiculture. 1.4 Describe the ecological importance of bees. 1.5 State the global decline of bees and its causes. 1.6 Describe the role of apiculture in	• Discuss apiculture and related terms. • Outline the history of beekeeping. • State economic importance. • Describe ecological importance. • State global decline of bees and CCD. • Describe role in climate-smart agriculture. • Describe Nigerian apiculture sector. • Outline the national skills-gap mandate.	Whiteboard, markers, projector, charts. Sample hive products (honey, beeswax, propolis). Lecture notes, reference textbooks (Crane — World History of Beekeeping;	• Tour the institutional or local apiary. • Identify hives, beekeeping equipment and protective gear. • Examine sample hive products — honey of different colours and viscosities, beeswax, propolis and pollen. • Conduct a survey of local beekeepers and document species, hive types, scale and marketing channels.	Guide students to: • Tour the institutional or local apiary. • Identify hives, beekeeping equipment and protective gear. • Examine sample hive products — honey of different colours and viscosities, beeswax, propolis and pollen. • Conduct a survey of local beekeepers	Institutional/local apiary. Sample hive products. Survey forms, transport. Camera, recording sheets, PPE.

	climate-smart agriculture and food security. 1.7 Describe the structure of the Nigerian apiculture sector. 1.8 Outline the national skills-gap mandate for apiculture as a compulsory training area in animal-production curricula.		Adjare — Beekeeping in Africa; FAO Apiculture Manual). Internet, video clips.	• Prepare a one-page profile of a local beekeeping enterprise.	and document species hive types, scale and marketing channels. • Prepare a one-page profile of a local beekeeping enterprise.	
GENERAL OBJECTIVE 2.0: Understand bee biology, the structure of a honey-bee colony, the three castes, the bee life cycle and colony communication.						
2	2.1 Describe the taxonomy of honey bees. 2.2 Describe the external anatomy of the honey bee. 2.3 Describe internal anatomy briefly 2.4 Describe the three castes. 2.5 Describe the life cycle of the honey bee. 2.6 Describe the colony as a super-organism.	• Describe taxonomy. • Describe external anatomy. • Describe internal anatomy briefly. • Describe the three castes. • Describe the bee life cycle. • Describe colony as super-organism and communication. • Describe colony reproduction. • Describe colony	Charts of bee anatomy and life cycle. Projector, whiteboard, sample bee specimens (queen, worker, drone) preserved in alcohol or pinned. Microscope, reference textbooks, internet,	• Identify queen, worker and drone bees from a sample colony or preserved specimens. • Record morphological differences. • Examine the external anatomy of a bee under stereomicroscope. • Identify head parts, pollen basket and sting.	• Guide students to: • Identify the three castes. • Examine bee anatomy under microscope. • Examine brood at different stages. • Observe foraging bees. • Observe and interpret the waggle dance.	Live colony at apiary. Preserved/pinned bee specimens. Stereomicroscope, hand lens. Comb samples with brood. Bee suit, smoker, hive tool, PPE.

	2.7 Describe colony reproduction. 2.8 Describe colony defence.	defence.	videos.	• Examine bee brood at different developmental stages on a comb (egg, larva, capped pupa). • Observe foraging bees at the apiary; identify pollen and nectar foragers. • Observe a waggle dance (where possible) and interpret direction and distance.		
GENERAL OBJECTIVE 3.0: Understand major honey-bee species and tropical races in Nigeria						
3	3.1 Describe the principal honey-bee species. 3.2 Describe the races of Apis mellifera relevant to Africa. 3.3 Describe characteristics of Apis mellifera adansonii. 3.4 Compare African vs European honey bees. 3.5 Describe other bees of importance in Nigeria. 3.6 Outline bee	• Describe principal honey-bee species. • Describe African races of Apis mellifera. • Describe characteristics of A. m. adansonii. • Compare African and European bees. • Describe stingless bees in Nigeria. • Outline bee genetics and breeding. • Describe queen-rearing principles.	Charts of bee species and races, distribution maps. Projector, whiteboard, sample preserved specimens. Reference textbooks, internet, videos.	• Identify Apis mellifera adansonii by morphological features (size, abdominal banding) under microscope. • Identify stingless bees if available at the institutional apiary. • Compare a European honey-bee specimen with an African specimen (morphology and behaviour notes). • Demonstrate basic	• Guide students to: • Identify A. m. adansonii. • Identify stingless bees. • Compare European and African bees. • Demonstrate queen-cup grafting. • Discuss management implications.	Bee specimens (different species and races). Stereomicroscope, hand lens. Queen-rearing frame and cups. Grafting tool, reference charts, PPE.

	genetics and breeding briefly. 3.7 Describe queen-rearing principles. 3.8 Describe Africanised honey bees (AHB) and the implications for management.	• Describe Africanised bees.		queen-cup grafting on a queen-rearing frame (where possible). • Discuss management implications of A. m. adansonii defensiveness.		
GENERAL OBJECTIVE 4.0: Understand the set-up of an apiary with appropriate equipment and facilities.						
4-5	4.1 Describe site selection for an apiary. 4.2 Describe environmental factors. 4.3 Describe traditional hives. 4.4 Describe the Kenya top-bar hive (KTBH). 4.5 Describe the Langstroth hive dimensions, advantages. 4.6 Describe other modern hives briefly. 4.7 Describe hive components. 4.8 Describe beekeeping protective	• Describe site selection. • Describe environmental factors. • Describe traditional hives. • Describe top-bar hive. • Describe Langstroth hive. • Describe other modern hives. • Describe hive components. • Describe protective equipment. • Describe beekeeping tools. • Describe apiary layout. • Describe records.	Charts of hive types and apiary layouts. Projector, whiteboard, sample hives (top-bar, Langstroth, traditional) and components. Sample equipment, reference textbooks, internet, videos.	• Conduct a site survey of the institutional apiary against established criteria; recommend improvements. • Construct or assemble a Kenya top-bar hive from locally available materials (wood, mesh wire). • Assemble a Langstroth hive from kit (frames, foundation, brood box). • Don a beekeeping suit and demonstrate proper protective gear assembly. • Light a smoker.	Guide students to: • Conduct site survey and assessment. • Construct a top-bar hive. • Assemble a Langstroth hive. • Don a beekeeping suit. • Light a smoker. • Demonstrate use of tools. • Sketch apiary layout.	Wood, mesh wire, nails, hammer, saw. Top-bar hive plans, Langstroth hive kit and frames. Bee suits, gloves, veils, boots. Smoker, fuel (dry leaves, hessian, sawdust). Hive tool, bee brush, queen catcher, queen-marking pen. Drawing paper, ruler, pencil, PPE.

	equipment. 4.9 Describe beekeeping tools. 4.10 Describe apiary layout. 4.11 Explain the importance of bee keeping records.			• Demonstrate use of fuel materials (dry leaves, sawdust, hessian). • Identify beekeeping tools. • Use beekeeping tools (hive tool, brush, queen catcher). • Sketch a layout for a 10-hive apiary indicating hive spacing, orientation, water source and security fence.		
GENERAL OBJECTIVE 5.0: Know the management of honey-bee colonies using standard practices						
6-7	5.1 Describe colony-establishment methods. 5.2 Describe colony installation. 5.3 Describe routine hive inspection. 5.4 Describe seasonal colony. management 5.5 Describe swarm management. 5.6 Describe absconding. 5.7 Describe colony splits and how to	• Describe colony-establishment methods. • Describe colony installation. • Describe routine hive inspection. • Describe seasonal colony management. • Describe swarm management. • Describe absconding prevention. • Describe colony	Charts of colony management. Projector, whiteboard, swarm-trap photos, video clips. Sample inspection log, reference textbooks, internet.	• Bait a swarm trap and place at the apiary. • Check daily for occupancy. • Capture a swarm (where naturally available) or a wild colony. • Install a colony in a top-bar or Langstroth hive. • Conduct a routine hive inspection — light smoker, open hive, examine	Guide students to: • Bait a swarm trap. • Capture a swarm. • Install a colony. • Conduct a hive inspection. • Identify queen cells, drone brood and capped honey. • Make a colony split. • Prepare and feed sugar syrup. • Set up a water source.	Swarm trap (top-bar nuc box), swarm lure (lemon grass, propolis). Bee suits, smoker, hive tool, brush. Top-bar/Langstroth hives. Inspection log forms. Knife (for top-bar comb cutting), bee brush. Sugar, water, kettle, top feeder/frame feeder.

	make increase nucleus colonies. 5.8 Describe re-queening. 5.9 Describe feeding bees. 5.10 Describe water provision in the apiary.	splits. • Describe re-queening. • Describe feeding bees. • Describe water provision.		combs. • Identify queen, eggs, larvae, capped brood and food stores. • Record findings on inspection log. • Identify queen cells, drone brood and capped honey on a comb. • Make a colony split into a nucleus hive (where colony is strong). • Prepare 1:1 sugar syrup and feed to a weak colony using a top feeder. • Set up a water source at the apiary.		Water trough/dripper, PPE.
GENERAL OBJECTIVE 6.0: Comprehend bee forage resources and pollination services effectively.						
8-9	6.1 Define bee forage. 6.2 Describe major bee forage. 6.3 Describe seasonal availability. 6.4 Describe honey-flow seasons and dearth periods. 6.5 Describe the relationship	• Explain bee forage. • Describe major bee forage in Nigeria. • Describe seasonal availability and bloom calendar. • Describe honey-flow and dearth seasons. • Describe forage-	Charts of bee forage and bloom calendar. Projector, whiteboard, sample plant specimens. Photographs of	• Identify common bee-forage trees, shrubs and weeds at the institutional farm or local environment (at least 15 species). • Examine bee foragers returning to the hive; observe pollen colour on	Guide students to: • Identify bee-forage species. • Observe pollen colour on returning foragers. • Develop a bloom calendar. • Plant bee forage. • Conduct pollen	Plant samples, bee-forage handbook. Hand lens, smartphone for photography. Bloom-calendar template. Forage seeds/seedlings (sunflower,

	between forage and honey type. 6.6 Describe pollination services bees provide to agricultural crops in Nigeria. 6.7 Describe contract pollination services as a source of income for beekeepers. 6.8 Describe planting bee forage. 6.9 Discuss the impact of agro-chemical use (pesticides, herbicides) on bee forage and bee health.	honey-type relationship. • Describe pollination services. • Describe contract pollination. • Describe planting bee forage. • Discuss impact of agro-chemicals.	nectar/pollen plants. Reference textbooks, internet.	pollen baskets and infer the plant source. • Develop a 12-month bloom calendar for the institutional locality from local interviews and observation. • Plant at least 5 bee-forage species (e.g. sunflower, hibiscus, neem, moringa) on a sample plot. • Conduct simple pollen analysis of honey under microscope (basic palynology). • Discuss with farmers how their pesticide use affects bees.	analysis under microscope. • Discuss pesticide impact with farmers.	hibiscus, moringa, neem). Hoe, watering can. Microscope, slides, water, KOH. Honey samples, PPE.
GENERAL OBJECTIVE 7.0: Know pests Control, predators, and diseases of bees using appropriate methods.						
10-11	7.1 Describe pests of bees. 7.2 Describe predators. 7.3 Describe bacterial diseases. 7.4 Describe fungal diseases. 7.5 Describe viral diseases.	• Describe pests of bees. • Describe predators. • Describe bacterial diseases. • Describe fungal diseases. • Describe viral diseases.	Charts of bee pests and diseases. Projector, whiteboard, photographs of damage signs. Sample	• Inspect a colony for signs of varroa (sticky-board count, alcohol-wash test). • Identify wax-moth damage on stored combs (tunnels, webbing). • Identify small hive	• Guide students to: • Conduct varroa-mite count. • Identify wax-moth damage. • Identify small hive beetle. • Inspect for AFB. • Identify chalkbrood	Sticky boards, pure alcohol, jars. Damaged comb samples. Wax-moth larvae and adult specimens. Small hive beetle specimens.

	7.6 Describe nosema disease (Nosema apis, Nosema ceranae). 7.7 Describe Colony Collapse Disorder (CCD). 7.8 Describe principles of integrated pest management (IPM) for bees. 7.9 Describe biosecurity protocols for the apiary.	• Describe nosema disease. • Describe CCD. • Describe IPM principles. • Describe biosecurity.	preserved pests (wax moth, small hive beetle). Reference textbooks, internet, videos.	beetle (adults and larvae) on a comb. • Inspect brood comb for AFB-suspect cells (sunken, dark, perforated cappings) and conduct the rope test. • Identify chalkbrood mummies in a hive. • Demonstrate ant-control measures — leg-stand grease cups, oil moats, ash skirts. • Set up biosecurity protocols for the apiary (visitor log, dedicated tools per apiary).	mummies. • Demonstrate ant control. • Set up biosecurity protocols.	Brood comb samples, match sticks (for AFB rope test). Ant-control materials (grease, used motor oil, ash, water). Biosecurity register, dedicated hive tools, PPE.
GENERAL OBJECTIVE 8.0: Know the process and value-add hive products to ensure quality						
12-13	8.1 Describe honey composition. 8.2 Describe honey types. 8.3 Describe honey ripening. 8.4 Describe harvesting from top-bar hives. 8.5 Describe harvesting from	• Describe honey composition. • Describe honey types. • Describe honey ripening. • Describe harvesting from different hive types. • Describe honey processing.	Charts of honey processing. Projector, whiteboard, sample hive products. Refractometer, processing equipment (extractor,	• Identify capped vs uncapped honey on a comb. • Assess readiness for harvest. • Harvest honey from a top-bar hive. • Cut combs, drain by gravity, filter. • Harvest honey from a Langstroth hive.	• Guide students to: • Identify capped honey. • Harvest from top-bar and Langstroth hives. • Test honey moisture. • Bottle and label honey. • Render beeswax.	Bee suits, smoker, hive tool, brush. Top-bar and Langstroth hives. Knife, uncapping fork, hot-air gun. Centrifugal extractor (radial or tangential). Strainer (food-grade), settling tank,

	Langstroth hives. 8.6 Describe harvesting from traditional hives. 8.7 Describe honey processing. 8.8 Describe honey-quality testing. 8.9 Describe honey adulteration tests. 8.10 Describe other hive products and their processing. 8.11 Describe value-addition products. 8.12 Describe storage of hive products.	• Describe honey-quality testing. • Describe honey adulteration tests. • Describe other hive products. • Describe value-addition products. • Describe storage of hive products.	settling tank, filters). Reference textbooks, internet, videos.	• Uncap with uncapping fork, extract using centrifugal extractor, filter and settle. • Test honey moisture using a refractometer. • Assess fitness for storage. • Bottle and label honey in 250-mL or 500-mL containers. • Design a label. • Render beeswax using a solar wax extractor or double-boiler and cast wax blocks. • Make beeswax candles or beeswax lip balm (formulation: 70% beeswax, 25% vegetable oil, 5% essential oil). • Collect propolis from a propolis trap (where available). • Make alcohol tincture (70% ethanol, 10-day maceration,	• Make candles or lip balm. • Collect propolis and make tincture. • Collect pollen. • Conduct honey-quality tests.	bottles, labels. Refractometer (0–90 °Brix or honey-specific). Solar wax extractor or double-boiler, beeswax mould. Beeswax, vegetable oil, essential oil, lip-balm tubes, wick, candle moulds. Propolis trap, ethanol, jar, filter paper. Pollen trap, drying trays, container, PPE.

				filtering). • Collect pollen from a pollen trap (where available). • Dry, weigh and store. • Conduct honey-quality tests for moisture and adulteration (water test, flame test).		
GENERAL OBJECTIVE 9.0: Know the application of marketing, regulatory standards and entrepreneurial skills in apiculture production						
14-15	9.1 Describe the apiculture value chain in Nigeria. 9.2 Describe cost components in apiculture. 9.3 Describe gross-margin and break-even analysis for an apiary enterprise. 9.4 Describe marketing channels. 9.5 Describe pricing strategies for honey and hive products. 9.6 Describe branding	• Describe the apiculture value chain. • Describe cost components. • Describe gross-margin and break-even. • Describe marketing channels. • Describe pricing strategies. • Describe branding and packaging. • Describe regulatory standards. • Describe export opportunities. • Describe	Charts of value chains and standards. Projector, whiteboard, sample bottled honey from market. Sample labels, NAFDAC/SON guidelines. Reference textbooks, internet, mobile devices.	• Develop a one-page business plan for a 20-hive apiary enterprise. • Compute gross margin and break-even point for the same. • Develop a sample brand and label for a honey product (logo, label, NAFDAC mock-up). • Bottle honey in small jars with labels • Create an e-commerce listing on WhatsApp Business or Instagram etc.	• Guide students to: • Develop a business plan. • Compute gross margin and break-even. • Develop a brand and label. • Bottle, label and create e-commerce listing. • Visit a local market. • Investigate NAFDAC registration. • Conduct a debate. • Present a business plan.	Business-plan template. Calculator, computer/laptop with Excel. Honey samples, jars, labels, design app (e.g. Canva). Smartphone, social-media accounts. Transport for market visit, NAFDAC sample form. Projector, presentation board, PPE.

	and packaging. 9.7 Describe regulatory standards. 9.8 Describe export of honey. 9.9 Describe entrepreneurship in apiculture. 9.10 Describe gender and youth in apiculture. 9.11 Describe sustainability and One Health. 9.12 Describe support institutions for apiculture in Nigeria.	entrepreneurship pathways. • Describe gender and youth opportunities. • Describe sustainability and One Health. • Describe support institutions.		• Visit a local market and document honey prices, brands and packaging styles. • Investigate the NAFDAC registration process for a hive product. • Complete a sample application. • Group presentation: present the business plan with marketing strategy.		

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

COMPUTER APPLICATION IN ANIMAL PRODUCTION

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: COMPUTER APPLICATION IN ANIMAL PRODUCTION	**COURSE CODE: APT 329**	**CONTACT: 3 HOURS/WEEK**
	CREDIT UNIT: 3	**THEORETICAL: 1 HOUR/WEEK**
YEAR: I SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 2 HOURS/WEEK**
GOAL: This course is designed to equip students with computer application skills for effective animal production and management.		

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

1.0 Know how to apply advanced computer concepts and digital technologies in animal production systems;
2.0 Know how to use productivity software for data processing, analysis, reporting, and presentation in animal production;
3.0 Understand how to apply spreadsheet and database applications for livestock data management and decision-making;
4.0 Know how to design and manage computerized record-keeping systems in animal production enterprises;
5.0 Know how to use statistical software tools for data analysis and research in animal production;
6.0 Understand how to apply ICT tools in animal health monitoring, disease reporting, and biosecurity management;
7.0 Know how to use digital technologies for farm planning, communication, precision livestock management, and reporting;
8.0 Know how to manage digital data through appropriate data entry, storage, retrieval, backup, and security procedures;
9.0 Understand how to apply computer-based tools for research, extension, and productivity improvement in animal production systems;
10.0 Know advanced Precision Livestock Farming (PLF) systems and digital platforms;
11.0 Know how to prepare and present technical and scientific reports using appropriate computer applications.

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: COMPUTER APPLICATION IN ANIMAL PRODUCTION	COURSE CODE: APT 329	CONTACT: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: This course is designed to equip students with computer application skills for effective animal production and management.		
GENERAL OBJECTIVE 1.0 Know how to apply advanced computer concepts and digital technologies in animal production systems		

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Define computer concepts and digital technologies in animal production. 1.2 Explain the role of digital technologies in modern animal production systems. 1.3 Differentiate between conventional and digital animal production systems.	• Explain computer concepts and digital technologies in animal production • Discuss the role of digital technologies in modern animal production systems • Describe the difference between conventional and digital animal production systems	Whiteboard and markers Lecture notes Agricultural ICT textbooks Charts/diagrams of digital livestock systems Case studies on precision livestock production Computer softwares	• Identify digital tools and technologies used in livestock managemen.t • Apply computer technologies to support animal production operations. • Operate selected digital tools used in animal production systems. • Use of digital technologies for farm monitoring and management.	Guide students to: • Demonstrate the use of digital technologies in farm operations • Operate selected software and digital tools • Apply computer technologies to livestock management tasks • Use digital tools for monitoring and record management • Participate in hands-on exercises with farm management applications • Participate in practical activities using digital	Desktop or laptop computers Internet access Farm management software/applications Digital devices (smartphones, tablets) Sensors and monitoring devices (if available) Projector for demonstrations Sample

					technologies in animal production scenarios	livestock datasets Reliable power supply/backup
General Objective 2.0: Know how to use productivity software for data processing, analysis, reporting, and presentation in animal production						
2	2.1 Explain the concept and importance of productivity software in animal production 2.2 Explain the functions of word processing, spreadsheet, and presentation software 2.3 Differentiate between software applications for data processing, analysis, and presentation	• Discuss the concept and importance of productivity software in animal production • Discuss the functions of word processing, spreadsheet, and presentation software • Describe the difference between software applications for data processing, analysis, and presentation	Whiteboard and markers Lecture notes ICT textbooks and manuals Sample reports and presentation materials Charts showing software applications Computer soft wares	• Identify productivity software used in animal production systems • Apply spreadsheet software for data processing and basic analysis • Generate tables, charts, and graphs from livestock data • Present livestock information using presentation software • Use word processing software to prepare animal production documents and reports • Prepare presentation slides for animal production reports	Guide students to: • Demonstrate the use of word processing software for report preparation • Process and analyze livestock data using spreadsheets • Generate charts and graphs from animal production data • Prepare presentation slides • Carryout presentations using presentation software • Participate in practical exercises on report writing and data analysis	Desktop or laptop computers Word processing software (e.g., Microsoft Word, Google Docs) Spreadsheet software (e.g., Microsoft Excel, SPSS, Power Bi, Google Sheets) Presentation software (e.g., PowerPoint, Google Slides) Projector for

						demonstrations Sample livestock datasets Flash drives or cloud storage Reliable internet access Reliable power supply/backup
General Objective 3.0: Understand how to apply spreadsheet and database applications for livestock data management and decision-making						
3	3.1 Define spreadsheet and database applications in animal production. 3.2 Explain the importance of digital data management in livestock enterprises. 3.3 Explain the role of digital data management in livestock enterprises.	• Explain spreadsheet and database applications in animal production • Discuss the importance of digital data management in livestock enterprises • Discuss the role of digital data management in livestock enterprise	Whiteboard and markers Lecture notes ICT and database management textbooks Sample livestock records and reports Charts illustrating database structures	• Identify spreadsheet and database software used in animal production systems. • Check the differences between spreadsheet and database applications. • Apply spreadsheet tools for livestock data entry, calculation, and analysis. • Create simple databases for livestock record	Guide students to: • Demonstrate spreadsheet operations for livestock data management • Enter and analyze livestock data using spreadsheets • Create simple livestock databases • Generate tables, charts, and reports • Participate in practical exercises on data retrieval and analysis • Use analyzed data for farm management	Desktop or laptop computers Spreadsheet software (e.g., Microsoft Excel, SPSS, Power Bi, Google Sheets) Database software (e.g., Microsoft Access, MySQL)

				management. • Generate reports, tables, and charts from livestock data. • Use analyzed data to support farm decision-making.	decisions	Sample livestock datasets Projector for demonstrations Flash drives or cloud storage Internet access (optional) Reliable power supply/backup
General Objective 4.0: Know how to design and manage computerized record-keeping systems in animal production enterprises						
4	4.1 Define computerized record-keeping systems in animal production. 4.2 Explain the importance of computerized records in livestock enterprises. 4.3 Differentiate between manual and computerized record-keeping systems.	• Explain computerized record-keeping systems in animal production • Discuss the importance of computerized records in livestock enterprises. • Discuss the difference between manual and computerized record-keeping systems	Whiteboard and markers Lecture notes Sample livestock record books and templates ICT and farm management textbooks Charts showing record management systems	• Identify types of records maintained in animal production systems. • Design simple computerized record templates for livestock enterprises. • Create computerized records using appropriate software applications. • Manage livestock records through proper updating, storage, and	Guide students to: • Demonstrate creation of computerized livestock records using spreadsheets or databases • Design record templates for animal production enterprises • Create and updating digital records • Store and retrieve livestock information electronically • Participate in practical exercises on computerized farm	Desktop or laptop computers Spreadsheet software (e.g., Microsoft Excel, SPSS, Power Bi, Google Sheets) Database software (e.g., Microsoft Access, MySQL)

				retrieval procedures. • Apply computerized records for farm planning and decision-making.	record management • Apply records for farm management decisions	Sample livestock production data Projector for demonstrations Flash drives or cloud storage Internet access (optional) Reliable power supply/backup
General Objective 5.0: Know how to use statistical software tools for data analysis and research in animal production						
5	5.1 Define statistical software tools used in animal production research. 5.2 Explain basic functions and outputs of statistical tools. 5.3 Explain the importance of statistical software in data analysis. 5.4 Differentiate between manual and computer-based statistical analysis.	• Explain statistical software tools used in animal production research • Discuss basic functions and outputs of statistical tools • Discuss the importance of statistical software in data analysis • Describe the difference between manual and computer-based statistical analysis	Whiteboard and markers Lecture notes ICT and statistics textbooks Sample research datasets Charts showing software outputs	• Identify common statistical software applications (e.g., Excel, SPSS, R). • Install basic statistical software tools. • Enter research data into statistical software correctly. • Analyze livestock and research data using appropriate statistical tools.	Guide students to: • Demonstrate installation and interface of statistical software • Enter livestock research data into software • Apply statistical functions (mean, percentage, charts, etc.) • Analyze datasets using software tools • Interpret software-generated outputs • Participate in practical	Desktop or laptop computers Statistical software (e.g., Microsoft Excel, SPSS, R) Sample livestock datasets Projector for demonstrations Internet

	5.5 Explain statistical outputs for research decision-making.	• Discuss the interpretation of statistical outputs for research decision-making			exercises using real or simulated data	access (for software downloads/updates) Flash drives or cloud storage Reliable power supply/backup
General Objective 6.0: Understand how to apply ICT tools in animal health monitoring, disease reporting, and biosecurity management						
6	6.1 Define ICT tools used in animal health management and biosecurity. 6.2 Explain the role of ICT in disease monitoring and reporting systems. 6.3 Differentiate between traditional and ICT-based disease reporting systems. 6.4 Discuss health data generated from ICT-based systems for decision-making.	• Explain ICT tools used in animal health management and biosecurity • Discuss the role of ICT in disease monitoring and reporting systems • Discuss the difference between traditional and ICT-based disease reporting systems • Explain health data generated from ICT-based systems for decision-making	Whiteboard and markers Lecture notes ICT and veterinary textbooks Case studies on disease outbreaks Charts showing disease reporting flow systems	• Identify ICT tools used in animal health management (mobile apps, databases, sensors, email systems). • Apply ICT tools to record and monitor animal health data. • Report disease outbreaks using ICT platforms. • Use digital tools to support biosecurity management in animal production systems.	Guide students to: • Demonstrate use of ICT tools for recording animal health data • Enter and update health records using digital platforms • Report simulated disease outbreaks using ICT tools • Use mobile apps or spreadsheets for health monitoring • Participate in exercises on biosecurity data recording and reporting • Analyze health information from ICT systems	Desktop or laptop computers Smartphones or tablets Internet access Livestock health management software or apps (e.g., KoboToolbox, ODK, farm apps.) Sample animal health records Projector for demonstrations

						Flash drives or cloud storage Reliable power supply/backup
General Objective 7.0: Know how to use digital technologies for farm planning, communication, precision livestock management, and reporting						
7	7.1 Define digital technologies used in modern animal production systems. 7.2 Explain the importance of digital tools in farm planning, communication, and precision livestock management. 7.3 Differentiate between traditional and digital farm management systems. 7.4 Explain digital data for farm decision-making and reporting.	• Explain digital technologies used in modern animal production systems • Discuss the importance of digital tools in farm planning, communication, and precision livestock management • Discuss the difference between traditional and digital farm management systems • Discuss the interpretation of digital data for farm decision-making and reporting	Whiteboard and markers Lecture notes ICT and livestock management textbooks Charts showing digital farm systems Case studies on precision livestock farming	• Identify digital technologies used in farm operations (apps, sensors, Global Positioning System (GPS), software systems) • Apply digital tools for farm planning and livestock management activities • Use of digital platforms for farm communication and reporting • Use precision livestock management tools for monitoring animal performance	Guide students to: • Demonstrate use of digital tools for farm planning and scheduling • Use communication platforms (email, messaging apps., farm apps.) • Apply precision livestock tools for monitoring animals • Enter and retrieve farm data using digital systems • Participate in practical exercises on farm reporting using digital platforms	Desktop or laptop computers Smartphones and tablets Internet access Farm management software/apps GPS devices and (optional) livestock sensors Projector for demonstrations Sample farm data Flash drives or cloud storage Reliable power

						supply/backup
General Objective 8.0: Know how to manage digital data through appropriate data entry, storage, retrieval, backup, and security procedures						
8-9	8.1 Define digital data management in animal production systems. 8.2 Explain the importance of proper data entry, storage, retrieval, backup, and security. 8.3 Differentiate between secure and insecure data management practices.	• Explain digital data management in animal production systems • Discuss the importance of proper data entry, storage, retrieval, backup, and security • Explain the difference between secure and insecure data management practices	Whiteboard and markers Lecture notes ICT textbooks and manuals Charts showing data management cycles Sample data management case studies	• Identify methods and tools for managing digital data. • Perform accurate data entry into digital systems. • Use appropriate file structures to organize and store digital data. • Retrieve stored data efficiently for decision-making. • Apply data backup procedures to prevent data loss. • Demonstrate basic data security practices in digital systems.	Guide students to: • Demonstrate proper data entry procedures using spreadsheets or databases • Create folders and organize digital files • Enter and store livestock data correctly • Retrieve saved data from digital storage systems • Demonstrate data backup procedures (USB, cloud storage, external drives) • Apply basic data security practices (passwords, access control) • Participate in practical exercises on data management scenarios	Desktop or laptop computers Spreadsheet software (e.g., Microsoft Excel, Google Sheets) Database software (e.g., Microsoft Access) External storage devices (USB drives, external hard drives) Cloud storage platforms (e.g., Google Drive) Sample livestock datasets

						Projector for demonstrations Internet access Reliable power supply/backup
General Objective 9.0: Understand how to apply computer-based tools for research, extension, and productivity improvement in animal production systems						
10-11	9.1 Define computer-based tools used in animal production systems. 9.2 Explain the role of computer applications in research, extension, and productivity improvement. 9.3 Differentiate between traditional and computer-based extension methods. 9.4 Explain digital information for farm planning and decision-making.	• Explain computer-based tools used in animal production systems • Discuss the role of computer applications in research, extension, and productivity improvement • Describe the difference between traditional and computer-based extension methods • Discuss digital information for farm planning and decision-making	Whiteboard and markers Lecture notes ICT and agricultural extension textbooks Charts showing digital extension systems Case studies on ICT in animal production	• Identify computer-based tools used for research and extension services. • Apply computer-based tools for research data management and analysis. • Use digital platforms for extension communication and information dissemination. • Demonstrate the use of computer applications for improving livestock productivity.	Guide students to: • Demonstrate use of computer-based tools for research and extension activities • Apply digital tools for livestock data management and reporting • Use communication platforms for extension services • Access and share agricultural information digitally • Participate in practical exercises using farm management and research software • Interpret computer-generated outputs for decision-making	Computers Internet access, Farm management and research software, Sample livestock datasets, Projector for demonstrations, Flash drives, Reliable power supply/backup.

General Objective 10.0: Know advanced Precision Livestock Farming (PLF) systems and digital platforms						
12-13	10.1 Define Precision Livestock Farming (PLF) and the data-to-decision pipeline. 10.2 Describe IoT sensor architecture. 10.3 Explain accelerometer-based oestrus, sickness, calving and lameness detection. 10.4 Describe drone applications: pasture monitoring (NDVI), herd counting, geo-fencing, anti-poaching surveillance. 10.5 Outline computer vision: body-condition scoring by image analysis, behaviour analysis, lameness scoring. 10.6 Describe	Define PLF data pipeline. • Describe IoT sensor architecture. • Explain accelerometer detection. • Describe drone applications. • Outline computer-vision applications. Describe blockchain traceability. • Outline farm-management software platforms. • Describe smartphone diagnostic apps. • Explain SMS extension. • Discuss Nigerian PLF ecosystem.	PLF architecture diagrams, IoT sensor samples, Accelerometer detection case studies, Drone (commercial unit), Computer-vision demo videos, Blockchain demo platforms. Farm-management software demos, Smartphone diagnostic apps. SMS-extension platform demos.	• Identify IoT sensors: RFID readers, GPS collars, rumen boluses. • Operate a drone for basic pasture monitoring and herd counting. • Interpret accelerometer dashboards. • Demonstrate computer-vision BCS on photographs. • Set up a blockchain traceability entry on a demo platform. • Operate a free trial of one farm-management software (DairyComp or Herdsman). • Install and operate at least three smartphone diagnostic apps. • Set up an SMS-based extension subscription.	Guide students to: Operate IoT sensor. • Operate drone and pasture monitoring. • Interpret accelerometer dashboard. • Demonstrate computer-vision BCS demonstration • Set up blockchain entry. • Operate farm-management software trial. • Carryout smartphone app installation/operation. • Setup SMS-extension subscription.	RFID readers, GPS collars, rumen boluses, Drone (small commercial unit), Accelerometer dashboard, BCS software demo (DairyComp, BCS Auto), Blockchain demo platform access. Computer, internet. Smartphones with apps, SMS-extension subscription credit.

	blockchain traceability. 10.7 Outline farm-management software platforms. 10.8 Describe smartphone-based diagnostic applications. 10.9 Explain SMS-based extension delivery. 10.10 10.10 Discuss Nigerian PLF ecosystem: Cattle ID.		NIRSAL digital farming materials.			
General Objective 11.0: Know how to prepare and present technical and scientific reports using appropriate computer applications						
14-15	11.1 Define technical and scientific reports in animal production context. 11.2 Explain the importance of computer applications in report preparation and presentation. 11.3 Present technical and scientific reports using oral and visual	• Explain technical and scientific reports in animal production context • Discuss the importance of computer applications in report preparation and presentation • Discuss technical and scientific reports using oral and visual methods	Whiteboard and markers Lecture notes Sample technical and scientific reports ICT and research writing textbooks Charts showing report structures	• Identify the components of technical and scientific reports • Use word processing software to prepare technical and scientific reports • Organize research and farm data into appropriate report formats • Generate tables, charts, and graphs for report presentation • Prepare presentation	Guide students to: • Demonstrate the use of word processing software for report writing • Organize and format reports using computer applications • Generate tables, charts, and graphs from livestock data • Prepare presentation slides using presentation software • Participate in presentations of	Desktop or laptop computers Word processing software (e.g., Microsoft Word, Google Docs) Spreadsheet software (e.g., Microsoft Excel, SPSS,

	methods.			slides using presentation software	technical and scientific reports • Participate in practical exercises on report writing and presentation	Google Sheets) Presentation software (e.g., PowerPoint, Google Slides) Projector for demonstrations Sample livestock datasets and reports Flash drives or cloud storage Internet access Reliable power supply/backup

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

YEAR II SEMESTER I

FARM ANIMAL PARASITOLOGY I

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: FARM ANIMAL PARASITOLOGY I	**COURSE CODE APT 411**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL:3 HOURS/WEEK**

GOAL: This course is designed to equip student with the knowledge of parasite affecting farm animals, clinical signs, mode of transmission, treatment, prevention, control and their economic importance.

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

1.0 Know common terminologies use in Parasitology;
2.0 Know common types of animal parasites;
3.0 Know the effects of animal parasites on Nigerian animal industry;
4.0 Know parasitic conditions caused by nematodes, cathodes, and trematodes;
5.0 Know the protozoan parasites of significance in Nigeria;
6.0 Know the effects of Anthropoid parasites on farm animals;
7.0 Understand the application of integrated One Health, AMR stewardship and welfare-integrated parasitology;
8.0 Know the drugs and chemicals and for deworming dipping and spraying farm animals against various parasites.

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY						
COURSE TITLE: FARM ANIMAL PARASITOLOGY I		COURSE CODE APT 411		CONTACT HOURS: 4 HOURS/WEEK		
		CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK		
YEAR: II SEMESTER: I		PRE-REQUISITE:		PRACTICAL:3 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge of parasite affecting farm animals, clinical signs, mode of transmission, treatment, prevention, control and their economic importance.						
GENERAL OBJECTIVE 1.0: Know common terminologies in Parasitology.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Explain parasitological terms. 1.2 Explain the term; host. 1.3 List the different types of association between parasite and host. 1.4 List the general economic impotance of parasite in livestock.	• Describe the parasitological terms; parasites, parasitism etc • Discuss the different types of association between parasite and host e.g. symbiosis, commensalisms • Describe the general economic impotance of parasite in livestock	White board, marker, Textbooks, charts, videos, internet	• Identify common terms used in livestock parasitology. • Identify host of livestock parasite. • Identify the relationship between parasite and host in livestock production.	Guide the students to; • Identify common terms used in livestock parasitology • Identify host of livestock parasite • Identify the relationship between parasite and host in livestock production.	Eggs, larvae, adult parasite, slide, microscope, PPE
General Objective .2.0 Know common types of animal parasites						

2-3	2.1 List the major types of parasite affecting livestock. 2.2 Illustrat e the life cycle, vectors and hosts of nemato des. 2.3 List cestodes. 2.2 Explain the life cy cle, vectors and hosts of cestodes. 2.3 Describe matodes and describe their life cycle. 2.4 List vectors and hosts. 2.5 List immediate. measurement on detecting signs of ill health. 2.6 Explain the classification characteristics, distribution, life	• Explain the major type of parasite affecting livestock • Explain the life cycle, vectors and hosts of nematodes. • Explain cestodes • Explain the life cy cle, vectors and hosts of cestodes. • Describe matodes and describe their life cycle • Explain vectors and hosts. • Describe immediate measurement on detecting signs of ill health • Explain the classification characteristics, distribution, life cycle, vectors, hosts of protozoa. • Explain the characteristics, distribution, life cycle, vectors, hosts etc, of nematodes, cestodes and trematodes	White board, marker, Textbooks, charts, videos, internet	• Identify characteristics, life cycle, vectors, hosts of protozoa. • Identify measures of detecting signs of ill health e.g. isolation of sick.	Guide the students to; • Participate in observing morphological features of major parasite affecting livestock production • Detect signs of ill health caused by parasitic infection	Egg, parasite, animal, PPE,

	cycle, vectors, hosts of protozoa. 2.7 List the characteristics, distribution, life cycle, vectors, hosts etc, of nematodes, cestodes and trematodes.					
General Objective 3.0: Know the effects of animal parasites on Nigerian animal industry						
4-5	3.1 Explain parasite. 3.2 List the direct and indirect effects of animal parasites on the economy of the produce and the nation. 3.3 Explain the effects of parasites and geographical spread on animal production in nigeria.	• Explain parasite • Explain the direct and indirect effects of animal parasites on the economy of the produce and the nation • Explain the effects of parasites and geographical spread on animal production in nigeria	White board, marker, Textbooks, charts, videos, internet	•Identify the direct and indirect effect of parasite on livestock production in Nigeria. •Identify the effect of parasite and geographical spread on animal production in Nigeria.	Guide the student to; •Participate in observing direct and indirect effect of parasite on livestock production in Nigeria •Observe the effect of parasite and geographical spread on animal production in Nigeria	Map
General Objective 4.0: Know parasitic conditions caused by nematodes, cathodes, and trematodes						

6	4.1 List the effect of nematodes on animals. 4.2 Explain the life cycle, effect on host,prevention and control of roundworms in cattle, sheep, swine and poultry. 4.3 Describe the life cycle, effect on host, prevention and control of hook worms in cattle, sheep, swine and poultry. 4.4 Describe the effect of cathodes on animals. 4.5 Describe the life cycle, effect on host,prevention and control of e.g. Diphylidum, caninum, moneizia etc.	• Explain the effect of nematodes on animals. • Explain the life cycle, effect on host,prevention and control of roundworms in cattle, sheep, swine and poultry. • Describe the life cycle, effect on host, prevention and control of hook worms in cattle, sheep, swine and poultry. • Describe the effect of cathodes on animals. • Describe the life cycle, effect on host,prevention and control of e.g. Diphylidum, caninum, moneizia etc. • Explain trematodes of significance to farm animals in Nigeria. • Explain the effects of flukes on farm animals. • Explain the life	White board, marker, internet, charts,	• Identify the effect of nematodes on animals. • Identify the effect of life cycle of parasite on animals. • Identify the effect of cestodes on animals. • Identify the effect of trematodes on animals. • Identify the effect of life cycle of parasite for control and prevention.	Guide the student to; • Observe features and effect of nematodes • Observe features and effect of trematodes • Observe features and effect of cestodes • Observe the life cycle of nematodes, cestodes and trematodes	Egg, microscope, slide, sample specimen, reagent

	4.6 Explain trematodes of significance to farm animals in Nigeria. 4.7 Explain the effects of flukes on farm animals. 4.8 Explain the life cycle, effects on host, prevention and control of paramphistoma spp: Schistosoma spp and Fasciola spp.	cycle, effects on host, prevention and control of paramphistoma spp: Schistosoma spp and Fasciola spp.				
General Objective 5.0: Know the protozoan parasites of significance in Nigeria						
7-8	5.1 List protozoan parasites of significance to farm animals in Nigeria. 5.2 Explain the effects of protozoan parasites on farm animals. 5.3 Explain the life cycle, effect on host,prevention	• Describe protozoan parasites of significance to farm animals in Nigeria • Describe the effects of protozoan parasites on farm animals • Describe the life cycle, effect on host, prevention and control of e.g. Anaplasma spp, Babesia spp, Coccidiosis,	Whiteboard, marker, lecture notes, internet,	• Identify protozoan parasites of significance to farm animals in Nigeria. • Identify the effects of protozoan parasites on farm	Guide the students to; • observe protozoan parasites of significance to farm animals in Nigeria • Observe the effects of protozoan parasites on farm animals	Sample pecimens Glasswares Microscope, slides

	and control of e.g. Anaplasma spp, Babesia spp, Coccidiosis, Trypansoma spp,Theileria spp etc.	Trypansoma spp,Theileria spp etc.		animals.		
General Objective 6.o: Know the effects of Anthropoid parasites on farm animals						
9-10	6.1 Explain arthropod parasites of significance to farm animals in Nigeria. 6.2 Explain the effects of arthropoids on farm animals. 6.3 Explain the life cycle, effect on host, prevention and Control of: i. Housefly, Mosquitoes, Tetanus, Tsetse fly, Blowflies etc. ii. Lice, Fleas and Mange antes ii. Ticks, Soft and hard one host, two and three host ticks.	• Describe arthropod parasites of significance to farm animals in Nigeria • Describe the effects of arthropoids on farm animals. • Describe the life cycle and effect of athropoid on host, prevention and Control of: ➢ Housefly, Mosquitoes, Tetanus, Tsetse fly, Blowflies etc. ➢ Lice, Fleas and Mange antes ➢ Ticks, Soft and hard one host, two and three host ticks.	Whiteboard, marker, lecture notes, internet,charts	• Identify arthropod parasites of significance to farm animals in Nigeria. • Identify the effects of arthropoids on farm animals. • Identify the life cycle, effect on host, prevention and Control of arthropoids.	Guide students to: • Identify arthropod parasites of significance to farm animals in Nigeria • Identify the effects of arthropoids on farm animals • Identify the life cycle, effect on host, prevention and Control of arthropoids	Samples Specimens Glass wares Microscope

General Objective: 7.0: Understand the application of integrated One Health, AMR stewardship and welfare-integrated parasitology at HND level						
11-12	7.1 Outline the One Health Quadripartite framework. 7.2 Describe AMR stewardship in parasitology. 7.3 Explain FAMACHA© scoring and integrated parasite management at commercial-flock level. 7.4 Outline integrated welfare-aware parasite management. 7.5 Discuss Nigerian National Action Plan on AMR 2024–2028 and the role of the APT graduate. 7.6 Describe zoonotic-parasite surveillance	• Outline One Health Quadripartite framework (FAO–WOAH–WHO–UNEP) Joint Plan of Action 2022–2026. • Describe AMR stewardship in parasitology. • Explain FAMACHA and IPM. • Outline welfare-aware techniques. • Discuss Nigerian AMR action plan • Describe zoonotic-parasite surveillance. • Outline NCDC reporting requirements. • Explain digital herd-health dashboards. • Describe smartphone diagnostic apps. • Discuss One Health field role	One Health Joint Plan document, AMR stewardship guides, FAMACHA© cards, Welfare-aware parasite-mgmt protocols, Nigerian National Action Plan on AMR, Zoonotic-parasite case-study materials, NCDC reporting guidelines, Digital herd-health dashboard demos, Smartphone	• Conduct FAMACHA© scoring on a commercial small-ruminant flock and develop targeted-selective treatment plan. • Calculate FECRT from given pre/post-treatment data and identify resistance. • Compose a welfare-integrated parasite-management SOP for a commercial-livestock enterprise. • Set up a digital herd-health record for parasite-control monitoring. • Conduct zoonotic-parasite risk	Guide students to: •Conduct FAMACHA scoring and treatment-plan development. • Calculate FECRT and resistance identification. • Compose welfare-integrated SOP. • Setup digital herd-health record • Conduct zoonotic risk-assessment exercise. • Compose NCDC report drafting. • Demonstrate smartphone app. • Set up digital herd-health dashboard.	Commercial small-ruminant flock, FAMACHA© cards, FECRT data sheets, SOP templates, Computer/tablet with herd-health app, Risk-assessment templates, NCDC reporting templates, Smartphones with apps, Digital herd-health dashboard demo.

	under the One Health framework. 7.7 Outline NCDC notifiable-disease reporting requirements for zoonotic parasites in Nigeria. 7.8 Explain digital herd-health dashboards integrated with veterinary surveillance. 7.9 Describe smartphone-based diagnostic apps. 7.10 Discuss the role of the APT graduate as a One Health field actor on commercial farms.		diagnostic apps.	assessment for a Nigerian commercial cattle ranch. • Compose a draft NCDC notifiable-disease report. • Demonstrate at least 3 smartphone-based parasitology apps. • Set up a commercial-grade digital herd-health dashboard.		
General Objective: 8.0 Know the drugs and chemicals used for deworming dipping and spraying farm animals against various parasites						
13-15	8.1 List anti-parasitic drugs	• Describe anti-parasitic,	Whiteboard, marker,	• Identify anti-parasitic drugs	Guide the student to; • Observe anti-	Drugs Chemical

	currently in use 8.2 Explain the mode of action of the drugs mentioned. 8.3 List the methods of application of antelmintics, insecticides and acarisides to farm animals.	Antihelminthic, insecticide and acaroids • Describe the mode of action of the drugs mentioned • Describe the methods of application of antelmintics, insecticides and acarisides to farm animals.	lecture notes, internet,	currently in use: Antelmintic, insecticide and acaroids. • Apply the drugs in 7.1 above to prevent or remove parasites from farm anim.	parasitic, Antelmintic drugs, insecticide and acaroids. • Apply the drugs in 7.1 above to prevent or remove parasites from farm anim	Spraying equipment Animal Dip Spray Spray race Chemicals

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

PASTURE AND RANGE MANAGEMENT

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: PASTURE AND RANGE MANAGEMENT	**COURSE CODE: APT 412**	**CONTACT HOURS: 4HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
GOAL: The course is designed to provide students with the knowledge and production skills for management of common pasture and forage crops in Nigeria.		

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

1.0 Know the history and distribution of major forage crops and pasture in Nigeria;
2.0 Know the types/Classes of Pasture;
3.0 Know how to establish pasture or grassland;
4.0 Know the management and improvement of pasture/rangeland;
5.0 Understand the concept of range ecology in relation to the establishment of rangeland;
6.0 Know the various ways of preserving and storing pasture and forage crops;
7.0 Know the principles of forage utilization in livestock nutrition;
8.0 Understand Implementation of climate-smart, methane-mitigation and net-zero livestock pathways;
9.0 Know the role of government in pasture development.

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: PASTURE AND RANGE MANAGEMENT	COURSE CODE: APT 412	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: The course is designed to provide students with the knowledge and production skills for management of common pasture and forage crops in Nigeria		
GENERAL OBJECTIVE 1.0: Know the history and distribution of major forage crops and pasture in Nigeria		

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Define Pasture and Forage Crops. 1.2 Explain the role of pasture and forage crop in tropical agriculture and its economic importance. 1.3 Explain the history of pasture and forage crops in Nigeria. 1.4 Explain and draw the geographical distribution of major forage crops and grassland on the Nigerian map. 1.5 Explain the advantage and disadvantages of cultivated and natural pasture. 1.6 Explain common terminologies in pasture	• Explain Pasture and Forage Crops. • Explain the role of pasture and forage crop in tropical agriculture and its economic importance. • Explain the history of pasture and forage crops in Nigeria. • Explain and draw the geographical distribution of major forage crops and grassland on the Nigerian map. • Explain the advantage and disadvantages of cultivated and natural	Lecture note Assignments Smart boards, Markers, Internet files, Textbooks.	• Draw geographical distribution of major forage crops and grassland on Nigerian map. • Inspect cultivated and natural pasture and record their differences. • Create a contents on the common terminologies in pasture and range management.	Guide students to: • Draw geographical distribution of major forage crops and grassland on Nigerian map • Differentiate between cultivated and natural pasture • Understand common terminologies in pasture and range management	Smart board, markers, lecture notes, Textbooks,

	and range management	pasture. • Explain common terminologies in pasture and range management				
General Objective 2.0: Know the types/Classes of Pasture						
2	2.1 Explain the basis on which pasture and forage crops can be classified. 2.2 Explain the factors affecting the nutritional value and productivity of pasture 2.3 Identify the various pasture crops common in the immediate locality. 2.4 Explain the various pasture crops common in the locality and Nigeria in general.	• Explain the basis on which pasture and forage crops can be classified. • Explain the factors affecting the nutritional value and productivity of pasture • Explain the various pasture crops common in the immediate locality. • Explain the various pasture crops common in the locality and Nigeria in general.	White board, marker, Textbooks, charts, videos, internet	• Identify basis on which pasture and forage crops can be classified. • Identify factors affecting the nutritional value and productivity of pasture. • Identify various pasture crops common in immediate locality.	Guide students to • Identify basis on which pasture and forage crops can be classified • Identify factors affecting the nutritional value and productivity of pasture • Identify various pasture crops common in immediate locality	Tractor Plough Harrow Planter Knapsack Spray Pasture crops
General Objective 3.0: Know how to establish pasture or grassland.						

3	3.1 Describe the agronomic practices and principles in the establishment of new pasture and forage crops. 3.2 Describe the methods of planting pasture crops. 3.3 Explain the procedure for pasture/range establishment 3.4 Explain the role of climate and soil on pasture production. 3.5 Explain the factors/conditions affecting the germination of pasture and forage crops. 3.6 Explain the factors limiting pasture and forage crops production. 3.7 Distinguish between pure and mixed pasture.	• Discuss the agronomic practices and principles in the establishment of new pasture and forage crops • Explain the methods of planting pasture crops • Illustrate the procedure for pasture/range establishment • Demonstrate the role of climate and soil in pasture production • Discuss the factors/conditions affecting the germination of pasture and forage crops • Explain the factors limiting pasture and forage crops production • Differentiate between pure and mixed pasture • Explain the principles for the establishment of a mixed pasture	White board, marker, Textbooks, charts, videos, internet	• Create a medium sized pasture and legume fodder bank under rain fed or irrigation. • Create an album of major pasture and forage crop. • Create an album of various forage crop seeds.	Guide students to • Create a medium sized pasture and legume fodder bank under rain fed or irrigation. • Create an album of major pasture and forage crop • Create an album of various forage crop seeds	Tractor Plough Harrow Planter Knapsack Spray
General Objective 4.0: Know the management and improvement of pasture/rangeland						
4-5	4.1 Enumerate the objectives of renovating/improving pasture. 4.2 Describe the methods of improving/renovating old pasture/rangeland. 4.3 Describe the steps in	• Discuss the objectives of renovating/improving pasture • Explain the methods of improving/renovating old pasture/rangeland	White board, marker, Textbooks, charts, videos, internet	• Identify the steps in pasture renovating programmes improvement of natural grassland and establishment of induced grassland.	Guide students to • Identify the steps in pasture renovating programmes	Established Pasture Staff Students Establish pasture and forage crops.

	pasture renovating programmes improvement of natural grassland and establishment of induced grassland. 4.4 Define the following terms and their application in pasture management. i. Stocking rate (S/L) ii. Grazing period iii. Tropical livestock unit TLU iv) Hectare required for a given TLU (HR) 4.5 Explain the principles of pasture/range maintenance and management.	• Enumerate the steps in pasture renovating programmes improvement of natural grassland and establishment of induced grassland • Explain the following terms and their application in pasture management. ➢ Stocking rate (S/L) ➢ Grazing period ➢ Tropical livestock unit TLU iv) Hectare required for a given TLU (HR) • Describe the principles of pasture/range maintenance and management.		• Apply stocking rate in pasture management. • Apply grazing period in pasture management.	improvement of natural grassland and establishment of induced grassland • Apply Stocking rate in pasture management. • Apply Grazing period in pasture management	Pasture seeds farmland Buses
General Objective 5.0: Understand the concept of range ecology in relation to the establishment of rangeland.						
6-7	5.1 Differentiate between range and pasture. 5.2 Define Ecological succession, climax, disclimax. 5.3 List the factors that outer play to achieve climax e.g. flora, climate, fauna etc. 5.4 Identify the signs of a vegetation at its climax and anti-climax.	• Explain the difference between range and pasture • Discuss Ecological succession, climax, disclimax. • Identify the factors that outer play to achieve climax e.g. flora, climate, fauna etc. • Enumerate the signs of a vegetation at its	White board, marker, Textbooks, charts, videos, internet	• Identify the factors that outer play to achieve climax e.g. flora, climate, fauna etc. • Identify the signs of a vegetation at its climax and anti-climax. • Identify the biotic and abiotic factors that promote or destabilize	Guide students to • Identify the factors that outer play to achieve climax e.g. flora, climate, fauna etc. • Identify the signs of a vegetation at	Established Pasture Staff Students Establish pasture and forage crops. Pasture seeds farmland Buses

	5.5 List the biotic and abiotic factors that promote or destabilize a vegetation at its climax.	climax and anti-climax. • Discuss the biotic and abiotic factors that promote or destabilize a vegetation at its climax		a vegetation at its climax.	its climax and anti-climax. • Identify the biotic and abiotic factors that promote or destabilize a vegetation at its climax	
General Objective 6.0: Know the various ways of preserving and storing pasture and forage crops.						
8-9	6.1 List the advantages of pasture and forage crops preservation and storage. 6.2 Explain the difference between hay and silage, pasturing, bush foggage, haylage and soilage. 6.3 Explain the following: a) Benefit of hay and hay making b) Characteristics of quality hay c) Types of hay d) Methods of preparing and curing hay. 6.4 Identify various additives and preservatives used in storing. 6.5 Describe silage making under the following: a) Definition of and types of silo	• Discuss the advantages of pasture and forage crops preservation and storage • Define hay and silage, pasturing, bush foggage, haylage and soilage. • Discuss hay making under the following: ➢ Benefit of hay and hay making ➢ Characteristics of quality hay ➢ Types of hay ➢ Methods of preparing and curing hay. • Expain various additives and preservatives used in storing. • Discuss Identify	White board, marker, Textbooks, charts, videos, internet	• Demonstrate methods of preparing and curing hay. • Carry out the use preservatives to storing. • Make silages from various pasture and crops. • Control the determination of silage moisture content. • Feed silage to various livestock. • Construct silo.	Guide students to • Demonstrate methods of preparing and curing hay. • Carry out the use preservatives to storing. • Make silages from various pasture and crops. • Control the determination of silage moisture content. • Feed silage to various livestock • Construct silo	Silos Forage Harvester Hay baler Store

	b) Characteristics of good silage c) Forage preparing for ensiling d) Make silages from various pasture and crops. e) Additives and preservatives for silage. f) Control the determination of silage moisture content. g) Feeding silage to various livestock h) Advantages and disadvantages of feeding silage to livestock 6.6 Describe the construction of silo.	various additives and preservatives used in storing. • Explain silage making under the following a) Definition of and types of silo b) Characteristics of good silage c) Forage preparing for ensiling d) Make silages from various pasture and crops. e) Additives and preservatives for silage. f) Control the determination of silage moisture content. g) Feeding silage to various livestock h) Advantages and disadvantages of feeding silage to livestock • Explain the construction of silo				
General Objective 7.0: Know the principles of forage utilization in livestock nutrition.						
10-11	7.1 Explain the use of pasture and forage crop in livestock nutrition. 7.2 Explain method of forage	• Discuss the use of pasture and forage crop in livestock nutrition • Describe method of	White board, marker, Textbooks, charts,	• Carry out methods of forage utilization, association factors and the associated	Guide students to • Carry out methods of	Established Pasture Staff

	utilization, association factors and the associated factors. 7.3 List the factors that affect the feeding value of forages/range in livestock nutrition. 7.4 Explain the use of pasture and forage crop in the nutrition of: i. Beef cattle; ii. Dairy cattle; iii. Swine; iv. Sheep and goats; v. Poultry; vi. Rabbit.	forage utilization, association factors and the associated factors • Enumerate factors that affect the feeding value of forages/range in livestock nutrition. • Discuss the use of pasture and forage crop in the nutrition of: ➢ Beef cattle ➢ Dairy cattle ➢ Swine ➢ Sheep/goats ➢ (Poultry) Rabbit	videos, internet	factors. • Identify factors that affect the feeding value of forages/range in livestock nutrition. • Use pasture and forage crop to food: - Beef cattle - Dairy cattle - Swine - Sheep and goats - Poultry - Rabbit	forage utilization, association factors and the associated factors • Identify factors that affect the feeding value of forages/range in livestock nutrition • Use pasture and forage crop in the nutrition of: - Beef cattle - Dairy cattle - Swine - Sheep and goats - Poultry - Rabbit	Students Establish pasture and forage crops. Pasture seeds farmland Buses
General Objective 8.0: Understand Implementation of climate-smart, methane-mitigation and net-zero livestock pathways						
12-13	8.1 Outline livestock contribution (~14.5%) to anthropogenic GHG emissions and the FAO Pathways Towards	• Outline livestock-sector GHG contribution. • Describe methane-mitigation additives.	FAO Pathways report, 3-NOP and	• Identify methane-mitigation Nigerian tropical forages (Acacia, Calliandra,	Guide students to: • Prepare mitigation	Acacia, Calliandra, Leucaena, Gliricidia

	Lower-Emissions Livestock framework (2023). 8.2 Describe methane-mitigation feed additives. 8.3 Explain enteric-methane measurement. 8.4 Outline low-emission diet formulation. 8.5 Discuss Nigerian NDC commitments under the Paris Agreement and the role of the livestock sector. 8.6 Describe pasture-based carbon sequestration. 8.7 Explain carbon-credit mechanisms. 8.8 Outline Green Climate Fund (GCF) and Adaptation Fund opportunities for Nigerian climate-smart livestock projects. 8.9 Discuss climate-resilient livestock breeds. 8.10 Describe heat-stress mitigation.	• Explain methane measurement methods. • Outline low-emission diet formulation. • Discuss Nigerian NDC commitments • Describe carbon sequestration pathways. • Explain carbon-credit mechanisms. • Outline GCF/AdaptF financing. • Discuss resilient breeds. • Describe heat-stress mitigation.	seaweed sample information, Methane measurement diagrams, Nigerian NDC document, Carbon-sequestration guides, Verra/Gold Standard project examples, GCF financing documents, Nigerian indigenous-breed publications, Heat-stress mitigation diagrams	Leucaena, Gliricidia). • Calculate enteric methane emissions for a Nigerian dairy herd using IPCC Tier-2 formulas. • Formulate a low-emission diet ration. • Design a silvopasture system with Acacia/Leucaena overstory and Brachiaria understorey. • Compose a draft carbon-credit project proposal for a Nigerian dairy or beef operation. • Design a shade-and-sprinkler heat-stress mitigation layout for a 100-cow feedlot.	forages. • Calculate IPCC Tier-2 methane calculation. • Formulate low-emission diet • Formulate a low-emission diet ration • Design silvopasture. • Compose carbon-credit proposal. • Design heat-stress layout	samples, IPCC Tier-2 calculation worksheets, Feed-formulation software/spreadsheet, Silvopasture design templates, Carbon-credit proposal templates, Drawing materials, CAD software (where available).
General Objective 9.0: Know the role of government in pasture development						
14-15	9.1 Explain the role of Government and Food and Agricultural Organization (F.A.O.)	• Discuss the role of Government and Food and Agricultural Organization (F.A.O.)	Lectures notes, Whiteboard, Projector,	• Identify the role of Government and Food and Agricultural Organization (F.A.O.)	Guide students to • Identify the role of	Field trip To grazing reserves

	and forage crops production in Nigeria 9.2 Explain the use of grazing reserves, stock routes alley farming and their importance in livestock development. 9.3 State the regulations governing reserves and stock routes. 9.4 Explain the contribution of the Research Institutes and other relevant government and non-governmental agencies in pasture and forage crop development in Nigeria.	and forage crops production in Nigeria • Describe the use of grazing reserves, stock routes alley farming and their importance in livestock development • Explain the regulations governing reserves and stock routes. • Discuss the contribution of the Research Institutes and other relevant government and non-governmental agencies in pasture and forage crop development in Nigeria	Laptop computers, Textbooks etc.	and forage crops production in Nigeria • Demonstrate the use of grazing reserves, stock routes alley farming a • Identify the regulations governing reserves and stock routes. • Carry out Research relevant government and non-governmental agencies in pasture and forage crop development in Nigeria	Government and Food and Agricultural Organization (F.A.O.) and forage crops production in Nigeria • Demonstrate the use of grazing reserves, stock routes alley farming a • Identify the regulations governing reserves and stock routes. • Carry out Research relevant government and non-governmental agencies in pasture and forage crop development in Nigeria	

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

POULTRY PRODUCTION

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: POULTRY PRODUCTION	**COURSE CODE: APT 413**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**

GOAL: The course is designed to enable students understand the principles and practice of poultry production and be able to operate as poultry farmers or managers of poultry farms.

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

1.0 Know the origin and domestication of different breeds of poultry;
2.0 Understand the problems of housing and equipping poultry houses in Nigeria;
3.0 Understand brooding and rearing of chicks;
4.0 Know the physiology of egg production and the importance of egg quality;
5.0 Know the management of layers and broilers;
6.0 Know the management of turkeys, guinea fowls, ducks;
7.0 Understand hatchery operation and management;
8.0 Understand the management of parent stock;
9.0 Comprehend commercial hatchery biosecurity principles including Heating, Ventilation and Air Conditioning (HVAC), disinfection zoning and digital controls;
10.0 Know commercial egg handling; fumigation, electronic candling, weight-grading etc.;
11.0 Know commercial artificial insemination protocols in poultry breeder operations;
12.0 Know the application of Artificial Insemination (AI) techniques in poultry breeder birds.

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: POULTRY PRODUCTION	COURSE CODE: APT 413	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: The course is designed to enable students understand the principles and practice of poultry production and be able to operate as poultry farmers or managers of poultry farms.		
GENERAL OBJECTIVE 1.0: Know the origin and domestication of different breeds of poultry.		

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Explain the origin of different species of poultry. 1.2 Explain breed, strain, variety, hybrid. 1.3 Classify major breeds of poultry and describe distinguishing features. 1.4 Identify common hybrids in Nigeria and explain their importance in modern poultry production.	• Explain the origin of different species of poultry. • Explain breed, strain, variety, hybrid. • Identify and classify major breeds of poultry and describe distinguishing features. • Explain common hybrids in Nigeria and • Explain their importance in modern poultry production.	Charts and pictures of poultry breeds and hybrids.	• Identify five commercial breeds and hybrids in the institutional poultry unit. • Record distinguishing features.	Guide students to: • Identify five commercial breeds/hybrids in the institutional poultry unit. • Record distinguishing features	Live poultry (different breeds); breed identification charts.
General Objective 2.0: Understand the problems of housing and equipping poultry houses in Nigeria.						

2-3	2.1 Explain factors to be considered when citing poultry houses. 2.2 Outline weather conditions in various parts of Nigeria and their influence on housing type. 2.3 Distinguish between controlled-environment and naturally ventilated housing. 2.4 Identify suitable building materials for poultry housing 2.5 Explain influence of heat stress and loss in poultry and influencing factors. 2.6 Explain deep litter management and battery cage management in poultry production. 2.7 Describe various poultry housing designs and their features.	•Explain factors to be considered when citing poultry houses (sun direction, wind, topography, market proximity, environmental impact). • Outline weather conditions in various parts of Nigeria and their influence on housing type. • Distinguish between controlled-environment and naturally ventilated housing; state advantages/disadvantages. • Identify suitable building materials for poultry housing; state advantages and disadvantages. • Explain influence of heat stress and loss in poultry and influencing factors. • Explain deep litter management and battery cage	Chalkboard; buses; building materials; design drawings.	•Visit a commercial poultry house. •Sketch layout. • Record ventilation and citing features. • Evaluate litter condition.	Guide students to: •Visit a commercial poultry house; sketch layout; note ventilation and citing features; evaluate litter condition	Field trip transport; sketch pads; rulers; camera.

		management in poultry production. • Describe various poultry housing designs and their features.				
General Objective 3.0: Understand brooding and rearing of chicks.						
4	3.1 Describe preparation for receiving day-old chicks on the farm. 3.2 Identify equipment for brooding and rearing chicks and their functions. 3.3 Describe the procedure for effective brooding. 3.4 State the recommended temperature and humidity ranges at various developmental stages. 3.5 List schedule of special operations. 3.6 Describe litter management during brooding and rearing phases. 3.7 List nutrient requirements of pullets and broiler chicks. 3.8 Explain 'all-out' brooding and rearing policy. 3.9 Explain rearing of parent chicks (as-hatched and sexed).	• Describe preparation for receiving day-old chicks on the farm. • Explain equipment for brooding and rearing chicks and explain their functions. •Describe the procedure for effective brooding. • State the recommended temperature and humidity ranges at various developmental stages. • Explain schedule of special operations: vaccination, beak trimming,	Brooder house; brooder/hover; heat sources; flat trays; small drinkers.	•Set up brooder; receive and manage day-old chicks for 2 weeks •Record mortality, FCR and weight gain.	•Guide students to: •Set up brooder; receive and manage day-old chicks for 2 weeks; record mortality, FCR and weight gain	Brooder house; gas/electric brooder; feed trays; drinkers; day-old chicks; PPE.

		medication, etc. • Describe litter management during brooding and rearing phases. • Discuss nutrient requirements of pullets and broiler chicks. • Explain 'all-out' brooding and rearing policy. • Explain rearing of parent chicks (as-hatched and sexed); explain effects of restricted feeding programmes.				
General Objective 4.0: Know the physiology of egg production and the importance of egg quality.						
5	4.1 Explain the role of hormones in poultry and list those involved in egg production. 4.2 Explain effects of photoperiod and light intensity on sexual maturity and egg production. 4.3 Describe processes of egg formation and laying. 4.4 List consumer preferences for eggs.	• Explain the role of hormones in poultry and list those involved in egg production. •Explain effects of photoperiod and light intensity on sexual maturity and egg production.	Charts; egg grader; scales.	•Candle eggs from the layer flock. • Assess internal quality (air cell, Haugh unit); record data.	Guide students to: •Candle eggs from the layer flock; assess internal quality (air cell, Haugh unit); record data.	Egg candler; micrometer/ scales; recording sheets; eggs.

	4.5 List factors affecting external and internal egg quality (shell colour, yolk colour, Haugh unit). 4.6 Explain egg quality deterioration and techniques of egg quality preservation.	• Describe processes of egg formation and laying. • List consumer preferences for eggs. • Explain factors affecting external and internal egg quality (shell colour, yolk colour, Haugh unit). • Explain egg quality deterioration and techniques of egg quality preservation.				
General Objective 5.0: Know the management of layers and broilers.						
6	5.1 List equipment for layer and broiler production. 5.2 Describe and prepare nutrient requirements for layers and broilers. 5.3 Outline daily management routine in deep litter and battery cage systems. 5.4 State factors affecting performance of layers and broilers 5.5 Enumerate qualities of	• Describe equipment for layer and broiler production. •Describe and prepare nutrient requirements for layers and broilers. • Explain daily management routine in deep	Deep litter; battery cages.	•Manage a commercial layer flock: feed, water, record egg production, BW and FCR daily for 1 week.	Guide students to: •Manage a commercial layer flock: feed, water, record egg production, BW and FCR daily for 1 week.	Layer/broiler house; feed; drinkers; feeders; weighing scale; recording sheets.

	good layers and broilers. 5.6 Define culling and explain its advantages.	litter and battery cage systems. • State factors affecting performance of layers and broilers (broodiness, moulting, feeding, climate, diseases). • Enumerate qualities of good layers and broilers. • Define culling and explain its advantages.				
General Objective 6.0: Know the management of turkeys, guinea fowls, ducks						
7	6.1 Explain the importance of turkeys, guinea fowls and ducks in Nigeria's poultry industry. 6.2 Describe the brooding and rearing of their young. 6.3 State nutrient requirements and feed intake at different stages of production.	• Explain the importance of turkeys, guinea fowls and ducks in Nigeria's poultry industry; identify their breeds. •Describe the brooding and rearing of their young. • Explain nutrient requirements and feed intake	Chalkboard; photographs; reference texts.	•Observe management of turkey poults or guinea fowl keets at institutional farm. • Record housing and feeding data.	Guide students to: •Observe management of turkey poults or guinea fowl keets at institutional farm; record housing and feeding data. •.	Turkey/guinea fowl unit; PPE; observation sheets.

		at different stages of production.				
General Objective 7.0: Understand the management of parent stock.						
8	7.1 Explain general operational procedures in a breeding farm. 7.2 State factors affecting performance of broiler breeders. 7.3 Describe handling of hatching eggs. 7.4 Indicate the importance of specific nutrients (vitamins A, E and C) for breeders.	• Enumerate general operational procedures in a breeding farm. •Explain factors affecting performance of broiler breeders. • Describe handling of hatching eggs. • Explain the importance of specific nutrients (vitamins A, E and C) for breeders.	Hatcher; hatching egg samples.	•Carry out collection, cleaning, disinfection, storage and hatching of eggs correctly. • Assess egg selection criteria.	Guide students to: •Collect, clean, disinfect and store hatching eggs correctly; assess egg selection criteria.	Breeding flock or commercial source; egg trays; sanitiser; cool store; record sheets.
General Objective 8.0: Understand hatchery operation and management.						
9-10	8.1 Describe a hatchery. 8.2 Describe two main types of incubators and their functions. 8.3 Describe storage and handling of hatchable eggs. 8.4 Describe the candling of eggs.	• Describe a hatchery. • Identify and describe two main types of incubators and their functions. • Describe	Hatchery equipment; egg candler; incubator; hatcher.	• Operate incubator: set eggs, monitor T and RH, candle at day 7 and 14, transfer at day 18, record fertility and hatchability. • Calculate % fertility and %	Guide students to: • Operate incubator: set eggs, monitor T & RH, candle at day 7 and 14, transfer at day 18, record	Incubator; hatcher; egg candler; thermometer; hygrometer; hatching eggs; recording sheets.

	8.5 State temperature and humidity range in an incubator and hatchery. 8.6 Describe the position of eggs and the significance of turning eggs in the incubator. 8.7 Describe the technique of fumigating eggs in the incubator. 8.8 Describe transferring eggs from setting to hatching trays. 8.9 Describe taking off the hatch. 8.10 Explain causes of low fertility. 8.11 Explain factors affecting hatchability of fertile eggs. 8.12 Describe three methods of sexing day-old chicks.	storage and handling of hatchable eggs. • Describe the candling of eggs. • State temperature and humidity range in an incubator and hatchery. • Describe the position of eggs and the significance of turning eggs in the incubator. • Describe the technique of fumigating eggs in the incubator. • Describe transferring eggs from setting to hatching trays. • Describe taking off the hatch.		hatchability.	fertility and hatchability. • Calculate % fertility and % hatchability.	

		• Explain causes of low fertility. • List and explain factors affecting hatchability of fertile eggs. • Describe three methods of sexing day-old chicks.				
General Objective 9.0: Comprehend commercial hatchery biosecurity principles including HVAC, disinfection zoning and digital controls.						
11	9.1 Describe biosecurity zones in a commercial hatchery. 9.2 Explain HVAC requirements. 9.3 Describe all-in/all-out flow, footbath protocols and disinfection scheduling. 9.4 Explain use of digital egg-weight scales and automated hatcher controls. 9.5 Assign and evaluate a hatchery-design drawing (layout, zoning, HVAC).	• Describe biosecurity zones in a commercial hatchery (red, amber, green zones). • Explain HVAC requirements: positive pressure, air filtration, temperature and humidity control. • Describe all-in/all-out flow, footbath	Projector; hatchery layout diagrams; video resources; design drawing paper.	• Prepare a hatchery biosecurity plan and layout drawing for a 10,000-egg capacity hatchery. • Present to class.	Guide students to: • Prepare a hatchery biosecurity plan and layout drawing for a 10,000-egg capacity hatchery; present to class.	Drawing paper/CAD tool; projector; reference hatchery layout samples.

		protocols and disinfection scheduling. • Explain use of digital egg-weight scales and automated hatcher controls. • Assign and evaluate a				
General Objective 10.0: Know commercial egg handling; fumigation, electronic candling, weight-grading etc.						
12	10.1 Explain fumigation chamber design and operation for table eggs. 10.2 Describe electronic candling and its role in grading. 10.3 Explain weight-grading machine operation; classify eggs by weight grades. 10.4 Describe palletizing procedures for export. 10.5 Explain cold-chain transportation of table eggs: temperature requirements, packaging standards.	• Explain fumigation chamber design and operation for table eggs. • Describe electronic candling and its role in grading. • Explain weight-grading machine operation; classify eggs by weight grades. • Describe palletizing procedures	Fumigation chamber (or demo model); candling machine; egg grader; pallets; cold store.	• Grade a batch of 100 eggs by weight; record % per grade. • Prepare packaging label. • Calculate cold-chain requirements for transit.	Guide students to: • Grade a batch of 100 eggs by weight; record % per grade; prepare packaging label; calculate cold-chain requirements for transit.	Egg grader; balance; egg trays; packaging materials; cold store thermometer; recording sheets.

		for export. • Explain cold-chain transportation of table eggs: temperature requirements, packaging standards.				
General Objective 11.0: Know commercial artificial insemination protocols in poultry breeder operations						
13-14	11.1 Outline the commercial rationale for AI in broiler-breeder and layer-breeder flocks: higher fertility, optimised male:female ratio (1:30 with AI vs 1:10 natural). 11.2 Describe broiler-breeder AI workflow: collection room, semen lab, insemination flow. 11.3 Explain semen-diluent science: pH buffering, osmolality, energy source (glucose), antibacterial agents. 11.4 Describe commercial semen extenders: Beltsville Poultry Semen Extender (BPSE), Lake's, IGGKP. 11.5 Outline biosecurity in breeder AI: footbaths, dedicated PPE, equipment	Outline commercial rationale for AI. • Describe broiler-breeder AI workflow with diagrams. • Explain diluent science. • Describe commercial extenders Outline biosecurity. Explain hen-flock fertility management. • Describe fertility-	Commercial broiler-breeder AI manuals (Cobb, Ross), Diluent samples and recipes, AI workflow diagrams, PPE and biosecurity guides, Hen-flock fertility records, Hatch-of-fertile data sheets, Turkey AI guides, Olam/Niger Foods company profiles.	• Tour a commercial broiler-breeder AI operation (where accessible). • Practice semen collection and evaluation on cockerels from institutional breeder flock. • Prepare BPSE diluent from base recipe. • Maintain AI biosecurity protocols throughout practical. • Conduct	Guide students to: • Organise commercial breeder-AI tour. • Carryout semen collection and evaluation. • Conduct BPSE diluent preparation. • Enforce biosecurity protocols. • Conduct insemination cycle on hen flock. • Conduct candling and	Access to commercial breeder farm or institutional breeder flock, Cockerels and hens, AI kit, BPSE ingredients (glucose, monosodium glutamate, $MgCl_2$, K_2HPO_4, NaH_2PO_4), PPE, footbaths Hen flock (institutional), Candling equipment,

	sterilisation. 11.6 Explain hen-flock fertility management: AI cycle (twice weekly), record-keeping, individual-hen identification. 11.7 Describe fertility-evaluation methods: hatch-of-fertile, candling, breakout analysis. 11.8 Outline turkey AI 11.9 Explain duck and quail AI awareness (specialised markets). 11.10 Discuss the role of poultry-AI technicians in Nigerian commercial-poultry expansion (Olam Hatcheries, Niger Foods).	evaluation methods. • Outline turkey AI specifics. • Explain duck/quail AI awareness. • Discuss Nigerian poultry-AI workforce		insemination on a small hen flock at scheduled intervals. • Carry out candling of eggs and breakout analysis to assess fertility. • Maintain individual-hen AI records. • Compose a draft business plan for poultry AI service provision.	breakout analysis. • Carryout individual-hen record-keeping. • Carryout poultry-AI business-plan drafting.	Breakout-analysis kit, Record-keeping templates, Business-plan templates.
General Objective 12.0: Know the application of artificial insemination (AI) techniques in poultry breeder birds						
15	12.1Explain the rationale for AI in poultry breeding (heavy male problem, genetic progress). 12.2 Describe semen collection technique in broiler breeders (abdominal massage method). 12.3 Describe semen evaluation. 12.4 Describe insemination technique. 12.5 State biosecurity	• Explain the rationale for AI in poultry breeding (heavy male problem, genetic progress). • Describe semen collection technique in broiler breeders	Broiler breeder male birds; semen collection tube; microscope; insemination syringe;slides;thermometer; PPE.	• Observe semen collection from broiler breeder males. • Evaluate motility under microscope. • Perform insemination on 5 hens. • Record outcomes.	Guide students to • Observe semen collection from broiler breeder males; evaluate motility under microscope; perform insemination on 5 hens; record outcomes	Broiler breeder birds; semen collection tube; microscope; insemination syringe; lubricant; recording sheets; PPE; hand sanitiser.

	protocols for AI in poultry.	(abdominal massage method). • Describe semen evaluation: volume, colour, motility, concentration. • Describe insemination technique: eversion of cloaca, insemination device, depth, timing. • State biosecurity protocols for AI in poultry.				

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

SWINE PRODUCTION

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: SWINE PRODUCTION	**COURSE CODE: APT 414**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
Goal: This course is designed to provide students with skills and knowledge of modern techniques of swine production		

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

1.0 Know the history and development of the swine industry;
2.0 Know the different breeds and conformation of swine;
3.0 Know the management of swine from farrowing to market;
4.0 Know the systems of swine keeping as an enterprise;
5.0 Know the types of housing and equipment used in modern swine production;
6.0 Know the feeding of different classes of swine;
7.0 Understand breeding and reproduction in swine;
8.0 Know swine health care, disease prevention, control and management;
9.0 Know the marketing of swine products;
10.0 Understand commercial swine finishing, marketing and digital-commerce skills;
11.0 Know how to keep records in swine production as an enterprise.

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY						
COURSE TITLE: SWINE PRODUCTION		**COURSE CODE: APT 414**		**CONTACT HOURS: 4 HOURS/WEEK**		
		CREDIT UNIT: 4		**THEORETICAL: 1 HOUR/WEEK**		
YEAR: II SEMESTER: I		**PRE-REQUISITE:**		**PRACTICAL: 3 HOURS/WEEK**		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with skills and knowledge of modern techniques of swine production						
GENERAL OBJECTIVE 1.0: Know the history and development of the swine industry						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Weeks	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Describe the zoological classification, origin and domestication of swine. 1.2 Explain the history and development of the swine industry in Nigeria. 1.3 Explain favourable and unfavourable factors that affect swine production in Nigeria.	• Describe the zoological classification, origin and domestication of pigs. • Discuss the history and development of the pig industry in Nigeria. • Describe favourable and unfavourable factors that affect swine production in Nigeria.	Charts White board Markers Textbooks Charts of swine breeds Lecture notes	• Identify the zoological classification, origin and domestication of swine. • Create presentation slide on the history and development of the swine industry in Nigeria compared to other countries. • Identify favourable and unfavourable factors that affect swine production in Nigeria.	Guide students to: • Identify the zoological classification, origin and domestication of swine. • Compare the history and development of the swine industry in Nigeria to other countries. • Identify favourable and unfavourable factors that affect swine production in Nigeria.	Charts Whiteboard Marker Textbooks Internet Charts of breeds of feed Pictures of breeds of feed Videos Computer systems
General Objective 2.0: Know the different breeds and conformation of swines.						
2	2.1 List the main breeds of swine i. Indigenous breeds ii. Exotic breeds (e.g.	• List the main breeds of swine i. Indigenous breeds ii. Exotic breeds (e.g.	Breed charts Colour photos of pig breeds Whiteboard	• Identify and compare at least three pig breeds from	Guide students to: • Identify and compare at least three pig breeds	Live pigs (various breeds if available)

	Large White, Landrace, Duroc) iii. And their crosses 2.2 Identify the distinguishing characteristics of various breeds. 2.3 Distinguish between types of: pork, bacon and lard.	Large White, Landrace, Duroc) iii. And their crosses • Explain the distinguishing characteristics of various breeds. • Distinguish between types of: pork, bacon and lard.	Textbooks Computer systems Internet	photographs/live animals. • Label parts of a typical pig on a diagram. • Identify the label diagram of different parts the swine.	from photographs/live animals. • Label parts of a typical pig on a diagram. • Identify the label diagram of different parts the swine	Breed ID charts Blank pig diagrams Charts of feed Visits to commercial piggery
General Objective 3.0: Know the management of swines from farrowing to market						
3-5	3.1 Describe post-farrowing management of piglets. 3.2 Describe artificial rearing of orphan piglets. 3.3 Describe tuck/creep feeding for piglets. 3.4 Describe and demonstrate clipping of needle teeth. 3.5 Describe overlaying and apply measures of minimising incidences of overlaying. 3.6 Explain management practices: ear-notching, tattooing, ear/tail clipping, foot trimming, ring nose of hogs, castration. 3.7 Explain early and normal weaning and	• Describe post-farrowing management of piglets. • Describe artificial rearing of orphan piglets. • Describe tuck/creep feeding for piglets. • Describe and demonstrate clipping of needle teeth. • Describe overlaying and apply measures of minimising incidences of overlaying. • Explain management practices: ear-notching, tattooing, ear/tail clipping, foot trimming, ring nose of hogs, castration. • Explain early and	Piggery with different classes of pigs Ear notchers Tattooing machine Hoof trimmers Burdizzo Rubber rings Whiteboard Markers Computer system Internet	• Administer iron dextran (Fe) injection to neonatal piglets following correct dosage schedule. • Demonstrate cross-fostering of piglets between sows. • Perform elastration and surgical castration of piglets following aseptic technique. • Apply neonatal thermoregulation measures (heat lamp adjustment, creep mat, thermal monitoring). • Assist in a farrowing: position sow, assist birth, clear airways, apply cord dressing.	Guide students to: • Administer iron dextran (Fe) injection to neonatal piglets following correct dosage schedule. • Demonstrate cross-fostering of piglets between sows. • Perform elastration and surgical castration of piglets following aseptic technique. • Apply neonatal thermoregulatio n measures	Iron dextran vials, syringes, needles Farrowing house with sows Elastring applicator & rings Heat lamps, creep mats, digital thermometer Farrowing kit Disinfectant, gloves Computer system Internet

	factors determining time and type of weaning. 3.8 Describe creep feeding during suckling. 3.9 Explain piglet anaemia and importance of iron (Fe) injection. 3.10 Describe management of pigs during fattening.	normal weaning and factors determining time and type of weaning. • Describe creep feeding during suckling. • Explain piglet anaemia and importance of iron (Fe) injection. • Describe management of pigs during fattening.		• Ensure guard rails are well secured in the farrowing pen.	(heat lamp adjustment, creep mat, thermal monitoring). • Assist in a farrowing: position sow, assist birth, clear airways, apply cord dressing. • Ensure guard rails are well secured in the farrowing pen	
General Objective 4.0: Know the systems of swine keeping as an enterprise.						
6	4.1 Describe systems of pig keeping (advantages and disadvantages): i. Extensive ii. Semi-intensive iii. Intensive 4.2 Describe various types of swine enterprises: i. Farrow-to-wean ii. Feeder-pig operations iii. Finishing operations iv. Farrow-to-finish 4.3 Explain modern trends in swine production.	• Describe systems of pig keeping (advantages and disadvantages): ➢ Extensive ➢ Semi-intensive ➢ Intensive • Describe various types of swine enterprises: ➢ Farrow-to-wean ➢ Feeder-pig operations ➢ Finishing operations ➢ Farrow-to-finish • Explain modern trends in swine production.	Charts Field site Textbooks Whiteboard Markers Computer system Internet	• Compare at least two pig-keeping systems during field visit. • Sketch a layout for a proposed swine enterprise type. • Compare the economic advantages of various types of swine enterprises.	Guide student to • Compare at least two pig-keeping systems during field visit • Sketch a layout for a proposed swine enterprise type • Compare the economic advantages of various	Field visit transport Logbooks Graph paper Whiteboard Markers Computer system Internet Visit commercial fields and report the types of swine enterprises

					types of swine enterprises	
General Objective 5.0: Know the types of housing and equipment used in modern swine production.						
7-8	5.1 Describe the various types and features of pig housing. 5.2 Explain the design and care of pig housing. 5.3 Discuss the design and maintenance pig houses. 5.4 Describe major equipment used in swine production. 5.5 List some equipment (Heaters, feeders, drinkers etc) used in swine production. 5.6 Describe routine maintenance of basic equipment used in swine production.	• Describe the various types and features of pig housing. • Explain the design and care of pig housing. • Discuss the design and maintenance pig houses. • Describe major equipment used in swine production. • List some equipment (Heaters, feeders, drinkers etc) used in swine production. • Describe routine maintenance of basic equipment used in swine production.	Piggery unit Students Weighing balance Equipment catalogue Whiteboard Markers Computer system Internet Tool box	• Draft a dimensioned design for a farrowing pen and a finishing pen. • Carry out routine maintenance of at least three piggery equipment items. • Farm visit to at least two different commercial piggeries and draw sketches of farrowing pen etc.	Guide students to: • Draft a dimensioned design for a farrowing pen and a finishing pen. • Carry out routine maintenance of at least three piggery equipment items. • Farm visit to at least two different commercial piggeries and draw sketches of farrowing pen etc.	Drawing instruments Equipment maintenance tools Piggery unit on farm Visit commercial piggery
General Objective 6.0: Know the feeding of different classes of swines.						
9-10	6.1 Explain nutrient requirements of various classes of pigs. 6.2 Explain feeds and feeding in swine nutrition. 6.3 Describe the digestive	• Explain nutrient requirements of various classes of pigs. • Identify feeds and feed ingredients in swine nutrition. • Describe the digestive	Charts of swine nutrition Feed mill Feed ingredients Whiteboard	• Formulate and cost rations for: - Gestating/lactating sow - Breeders - Creep feed - Growers	Guide students to: • Formulate and cost rations for: - Gestating/lactating sow - Breeders - Creep feed	Charts Raw materials Feed mill Weighing scale Calculators Empty feed bags

	ability and digestion in pigs. 6.4 Describe feeding practices and methods. 6.5 Explain the value of pasture in swine nutrition. 6.6 Explain the relevance of silage to swine nutrition. 6.7 Discuss different rations. 6.8 Explain the effects of underfeeding and overfeeding.	ability and digestion in pigs. • Describe feeding practices and methods. • Explain the value of pasture in swine nutrition. • Explain the relevance of silage to swine nutrition. • Explain rations for: ➢ gestating/lactating sow ➢ breeders (gilts, sows, boars) ➢ creep feed ➢ growers ➢ finishers. • Explain the effects of underfeeding and overfeeding.	Markers Computer system Internet	- Finishers • Mix and weigh a batch using feed mill.	- Growers - Finishers • Mix and weigh a batch using feed mill.	Stickers Markers
General Objective 7.0: Understand breeding and reproduction in swine.						
11	7.1 Discuss the reproductive systems of the sows and boars. 7.2 List the reproductive hormones of the swine. 7.3 Explain breeding/reproductive habits under headings: i. Age at puberty ii. Heat period	• Discuss the reproductive systems of the sows and boars. • Explain the reproductive hormones of the swine • Explain breeding/reproductive habits under headings: ➢ Age at puberty ➢ Heat period ➢ Signs of heat	Whiteboard AI kits Charts Live animals Markers Computer system, Internet	• Identify a sow on heat and record all visible signs. • Assist in natural mating or perform AI procedure. • Draw a well labeled reproductive organs of sow and boar. • Identify sows on heat and do embryo transfer.	Guide students to: • Identify a sow on heat and record all visible signs. • Assist in natural mating or perform AI procedure. • Draw and label reproductive organs of sow	AI kit Live sows and boars Recording sheets Charts Disinfectant, gloves Pedometer Computer system Internet

	iii. Signs of heat iv. Age to breed gilts/boars v. Time of breeding vi. Mating methods and ratios vii. Gestation period viii. Synchronisation of oestrus ix. Pregnancy diagnosis x. Farrowing xi. Embryonic death and or abortion xii. Care during gestation xiii. Care before, during, after farrowing xiv. Care of suckling gilts and sows	➢ Age to breed gilts/boars ➢ Time of breeding ➢ Mating methods and ratios ➢ Gestation period ➢ Synchronisation of oestrus ➢ Pregnancy diagnosis ➢ Farrowing ➢ Embryonic death and or abortion ➢ Care during gestation ➢ Care before, during, after farrowing ➢ Care of suckling gilts and sows			and boar. • Identify sows on heat and do embryo transfer	
General Objective 8.0: Know swine health care, disease prevention, control and management.						
12	8.1 List the major swine diseases in Nigeria. 8.2 Describe etiology, prevention and control of swine diseases in Nigeria. 8.3 Explain nutritional deficiencies, infectious diseases and parasitic diseases of swine. 8.4 Explain ectoparasites of swine and apply control	• Explain the major swine diseases in Nigeria. • Describe etiology, prevention and control of diseases in 8.1. • Differentiate nutritional ailments from diseases in swine. • Explain endoparasites of swine and apply control measures.	Piggery unit Students Weighing balance Charts Knapsack sprayer Chemicals for cleaning, disinfections and fumigations	• Identify endoparasites and ectoparasites from samples/photograph • Administer a disinfection schedule for a pig house. • Fill in a held health programme schedule for a model piggery.	Guide students to: • Identify endoparasites and ectoparasites from samples/photograph • Prepare and administer a disinfection schedule for a	Parasite specimens / photographs Knapsack sprayer Disinfectants Health record forms Chemicals for cleaning, disinfections and

	measures. 8.5 Describe the maintenance of health programme schedule for pigs. 8.6 Explain biosecurity as it relates to pig management.	• Discuss ectoparasites of swine and apply control measures. • Design and maintain health programme schedule for pigs. • Clean and disinfect pig houses.	Computer system, Internet Whiteboard Markers		pig house. • Fill in a held health programme schedule for a model piggery	fumigations Computer system, Internet Whiteboard Markers
General Objective 9.0: Know the marketing of swine products						
13	9.1 Explain methods of marketingpigs and products 9.2 Describe market classes and grades for pigs, pork and wholesale cuts. 9.3 Explain factors affecting marketing and price in Nigeria. 9.4 Describe and prepare pigs for agricultural shows, shipment and transportation.	• Explain methods of marketing pigs and products: ➢ Terminal public market ➢ Livestock auction market ➢ Country/direct selling ➢ Wholesale cuts etc. • Explain market classes and grades for pigs, pork and wholesale cuts. • Explain factors affecting marketing and price in Nigeria. • Describe and prepare pigs for agricultural shows, shipment and transportation.	Charts Field visit site Textbooks Computer system, Internet Whiteboard Markers Market surveys	• Calculate break-even price and live-weight/carcass pricing for a finisher pig batch. • Assess body condition score (BCS) of finisher pigs against target for sale. • Create a simple social-media marketing post (WhatsApp/Facebook) advertising pigs for sale. • Simulate an e-commerce livestock listing, including product description, price, payment terms and delivery logistics. • Draft a business plan to form a pig	Guide a Student to • Calculate break-even price and live-weight/carcass pricing for a finisher pig batch. • Assess body condition score (BCS) of finisher pigs against target for sale. • Create a simple social-media marketing post (WhatsApp/Facebook) advertising pigs for sale. • Simulate an e-	Calculator spreadsheet Live finisher pigs BCS chart Smartphone / computer Sample listings Internet Whiteboard Markers Market surveys Advertisement (Tv,radio,social media etc.

				producer cooperative to enhance production processing and marketing	commerce livestock listing, including product description, price, payment terms and delivery logistics. • Formation of pig producer cooperative to enhance production processing and marketing	
General Objective 10.0: Understand commercial swine finishing, marketing and digital-commerce skills						
14	10.1 Outline commercial finishing-period management. 10.2 Describe gilt selection, finisher-pen layout, all-in/all-out flow, biosecurity zones. 10.3 Explain commercial pricing models. 10.4 Discuss Nigerian commercial pork-market value chains. 10.5 Outline export-niche awareness. 10.6 Describe digital	•Outline commercial finishing management. • Describe gilt selection and finisher-pen layout. • Explain pricing models. • Discuss Nigerian commercial pork market. • Outline export-niche awareness • Describe digital marketing strategy with case studies. • Explain Nigerian e-	Finisher-pen layout drawings, EUROP carcass-classification charts, Nigerian pork-market data, ECOWAS bacon/sausage export data. Digital	•Conduct commercial-grade BCS scoring on finishing pigs. • Take live-weight measurements and calculate Daily Weight Gain (DWG). • Perform basic carcass classification using EUROP guides.	Guide students to: • Conduct commercial-grade BCS scoring • Conduct DWG calculation. • Perform carcass classificati	Commercial finishing pigs, Weighing scale, calipers, EUROP classification guides, Calculators, worksheets Computer, internet, PowerPoint for pitch deck, NAFDAC application

	marketing strategy. 10.7 Explain Nigerian e-commerce. 10.8 Outline B2B channels. 10.9 Describe processed-pork product development. 10.10Discuss NAFDAC food-establishment registration, SON product standards.	commerce platforms. • Outline B2B channels. • Describe processed-pork products. • Discuss NAFDAC/SON compliance.	marketing case studies, Jumia/Konga seller materials, B2B pitch examples, Processed-pork product samples, NAFDAC/SON guides.	• Compute commercial-finishing feed budgets with break-even analysis. • Develop a complete digital-marketing plan for a swine enterprise: brand, target customers, channels, content calendar. • Set up a Jumia/Konga seller account (or simulated). • Compose a B2B pitch deck for a supermarket chain. • Draft NAFDAC food-establishment application.	on. • Compute feed-budget and break-even calculation. • Carryout digital marketing plan development. • Set up Jumia/Konga seller setup. • Conduct B2B pitch composition. • Carryout NAFDAC application drafting	templates.
General Objective 11.0: Know how to keep records in swine production as an enterprise						
15	11.1 Define records. 11.2 Explain the various types of records kept in swine enterprises. 11.3 Explain parameters included in a typical	• Explain records. • Explain the various types of records kept in swine enterprises. • Describe parameters included in a typical	Sample record forms Textbooks Computer system, Internet	• Design the following records from a model scenario: - Farrowing record	Guide students to: Design and complete the following records from	Blank record templates Model-scenario data set Stationery Computer

	record. 11.4 Discuss the nutritional value, and other uses of the pig to humanity.	record.	Whiteboard Markers Market surveys	- Feed intake and growth record - Health/vaccination record - Sales and marketing record - Complete the records in some production. • Summarize generated data into charts, tables, graphs etc. for easy analysis.	a model scenario: - Farrowing record - Feed intake and growth record - Health/vaccination record - Sales and marketing record • Summarize generated data into charts, tables, graphs etc. for easy analysis	system, Internet Whiteboard Markers Internet
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% **Total: 100%**						

HIDES AND SKIN PRODUCTION

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: HIDES AND SKIN PRODUCTION	**COURSE CODE: APT 415**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
GOAL: This course is designed to equip students with the knowledge and practical skills required for hides and skin improvement, leather manufacture, by-product processing, cold-chain management, and agribusiness development across the hides and skin value chain.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the composition, structure and functions of hides and skin of various animals; 2.0 Know the defects in hides and skin caused by diseases, parasites, injury and mechanical effects; 3.0 Understand the flaying of hides and skins of various animals of economic importance; 4.0 Understand the concept of curing hides and skins; 5.0 Appreciate hides and skin marketing channels in Nigeria; 6.0 Understand the procedures employed in hides and skin preparation for export; 7.0 Understand the processes of leather manufacture and modern tanning technology; 8.0 Know the processes of livestock by-product utilisation; 9.0 Understand cold chain and storage management for hides, skins and animal products; 10.0 Understand basic entrepreneurship and value-chain principles to the hides, skin and leather enterprise.		

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY						
COURSE TITLE: HIDES AND SKIN PRODUCTION		COURSE CODE: APT 415		CONTACT HOURS: 4 HOURS/WEEK		
		CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK		
YEAR: II SEMESTER: I		PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and practical skills required for hides and skin improvement, leather manufacture, by-product processing, cold-chain management, and agribusiness development across the hides and skin value chain.						
GENERAL OBJECTIVE 1.0: Understand the composition, structure and functions of hides and skin of various animals						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Discuss histology of hides and skins. 1.2 Explain the chemical composition. 1.3 Explain the functions of skin in various farm animals.	• Discuss histology of hides and skins (epidermis, dermis, hypodermis) • Explain the chemical composition — water, protein, fat, minerals • Explain the functions of skin in various farm animals	Charts, slides, skin specimens	• Identify the functions of the skin in various farm animals • Examine cross-sections of animal skin specimens. • label structures	Guide students to: • Identify the functions of the skin in various farm animals • Examine cross-sections of animal skin specimens; label structures	Lecture; question-and-answer technique
General Objective 2.0: Know the defects in hides and skin caused by diseases, parasites, injury and mechanical effects.						
2-3	2.1 Explain defects caused by diseases. 2.2 Describe defects from mange, ticks and ectoparasites. 2.3 Explain mechanical defects.	• Explain defects caused by diseases (anthrax, pox, eczema). • Describe defects from mange, ticks and ectoparasites • Explain mechanical defects — scratches, branding marks, knife	Skin samples, photographs, defect classification charts	•Identify defects on collected skin samples. •Complete grading sheet. • Record collected skin samples. •Write a technical report on field trip to skin shed.	•Guide students to: •Identify defects on collected skin samples; complete grading sheet Record collected skin	Lecture and practicals; field trip to skin shed

		cuts		•Grade hides by defect category using standard classification	samples •field trip to skin shed •Grade hides by defect category using standard classification	
General Objective 3.0: Understand the flaying of hides and skins of various animals of economic importance.						
4	3.1 Explain flaying terminology. 3.2 Describe manual and mechanical flaying techniques and equipment. 3.3 Outline faults resulting from bad flaying (asymmetry, over-trimming).	• Explain flaying terminology — initial tripping, cuts, trimming • Describe manual and mechanical flaying techniques and equipment • Outline faults resulting from bad flaying (asymmetry, over-trimming)	Flaying knives, drying sheds, tables	•Demonstrate manual flaying on slaughterhouse specimens. •Record faults observed.	•Guide students to: •Demonstrate manual flaying on slaughterhouse specimens •record faults observed	Lecture with practical demonstration; field trip
General Objective 4.0: Understand the concept of curing hides and skins.						
5	4.1 Explain the term "curing" and methods. 4.2 Describe drying methods. 4.3 Outline drying defects and how to correct them. 4.4 Explain quality parameters for cured hides ready for market.	Lecture; demonstration; field trips to curing facilities	Hides/skin, curing chemicals, drying sheds	• Undertake wet-salting and dry-salting of selected hides. • Record moisture loss at intervals.	• Guide students to: • Undertake wet-salting and dry-salting of selected hides; • Record moisture loss at intervals	Lecture; demonstration; field trips to curing facilities
General Objective 5.0: Appreciate hides and skin marketing channels in Nigeria.						
6	5.1 Describe marketing procedures. 5.2 Explain the economics and channels of hides and skin	• Describe marketing procedures — abattoir, licensed buying agents, middlemen, exporters	Flaying knives, tables, market records	• Visit a local skin market or collection centre. • Map the value chain	• Guide students to: • Visit a local skin market or	Lecture; market field trip; grade logbooks

	marketing. 5.3 Explain the significance of licensed hides and skin agents. 5.4 Explain hides and skin trade terminologies.	• Explain the economics and channels of hides and skin marketing • Explain the significance of licensed hides and skin agents • Discuss hides and skin trade terminologies		from farmer to exporter.	collection centre; • map the value chain from farmer to exporter	
General Objective 6.0: Understand the procedures employed in hides and skin preparation for export.						
7-8	6.1 Explain methods of preparing hides for export. 6.2 Explain appropriate folding and packaging for export. 6.3 Discuss the procedures involved in curing, drying, salting, and preservation of hides and skins.	• Explain methods of preparing hides for export — arsenication, insecticide spraying, dusting powder • Explain appropriate folding and packaging for export • Discuss the procedures involved in curing, drying, salting, and preservation of hides and skins.	Designed forms, record books, tannery vats, mini-tannery, dehiding equipment	• Identify different types of hides and skins. • Demonstrate flaying and cleaning procedures. • Practice curing of hides and skins using salting and drying methods. • Demonstrate preservation techniques to prevent spoilage. • Carry out sorting and grading of hides and skins according to quality standards.	Guide students to: • Identify different types of hides and skins. • Demonstrate flaying and cleaning procedures. • Practice curing of hides and skins using salting and drying methods. • Demonstrate preservation techniques to prevent spoilage. • Carry out sorting and	Lecture; illustration; field trips to tannery

					grading of hides and skins according to quality standards	
General Objective 7.0: Understand the processes of leather manufacture and modern tanning technology.						
9	7.1 Explain the concept and importance of leather manufacturing. 7.2 Identify the different types and sources of hides and skins used in leather production. 7.3 Describe the stages involved in leather processing and tanning. 7.4 Explain modern tanning technologies and their applications in the leather industry. 7.5 Differentiate between vegetable tanning, chrome tanning, and synthetic tanning methods. 7.6 Discuss the chemicals, equipment, and safety precautions used in tanning operations. 7.7 Explain the environmental and health implications of leather manufacturing processes.	• Explain the concept and importance of leather manufacturing. • Identify the different types and sources of hides and skins used in leather production. • Describe the stages involved in leather processing and tanning. • Explain modern tanning technologies and their applications in the leather industry. • Explain vegetable tanning, chrome tanning, and synthetic tanning methods. • Discuss the chemicals, equipment, and safety precautions used in tanning operations. • Explain the environmental and health implications of leather manufacturing processes	Designed forms, record books, tannery vats, mini-tannery, dehiding equipment	• Demonstrate soaking, liming, and dehairing processes. • Demonstrate fleshing and deliming operations. • Demonstrate vegetable tanning and chrome tanning methods. • Prepare tanning chemicals. • Apply tanning chemicals. • Identify basic tanning equipment and tools. • Demonstrate dyeing, fatliquoring, and leather finishing techniques.	Guide students to: • Demonstrate soaking, liming, and dehairing processes. • Demonstrate fleshing and deliming operations. • Demonstrate vegetable tanning and chrome tanning methods. • Prepare tanning chemicals. • Apply of tanning chemicals • Identify basic tanning	Tannery

					equipment and tools. • Demonstrate dyeing, fatliquoring, and leather finishing techniques.	
General Objective 8.0: Know the processes of livestock by-product utilisation						
10-11	8.1 Define livestock by-products. 8.2 Describe rendering processes for tallow and bone meal. 8.3 Explain blood meal production and its nutritive value as a feed ingredient. 8.4 Describe fleshing and splitting of hides as a by-product pathway. 8.5 List market outlets and economic value of each by-product.	• Explain livestock by-products — bone meal, tallow, blood meal, keratin products • Describe rendering processes for tallow and bone meal • Explain blood meal production and its nutritive value as a feed ingredient • Describe fleshing and splitting of hides as a by-product pathway • List market outlets and economic value of each by-product	Rendering equipment specimens, bone meal samples, blood meal samples, abattoir	• Collect blood samples. • Dry blood samples. • Carry out comparisons of yield from different slaughter animals.	Guide students to: • Collect blood samples • Dry blood samples • Carry out comparisons of yield from different slaughter animals	Lecture with demonstrations; visit rendering plant or abattoir
General Objective 9.0: Understand cold chain and storage management for hides, skins and animal products.						
12-13	9.1 Explain the cold chain concept and its importance for hides, skins, meat and vaccines. 9.2 Describe refrigeration equipment, temperature	• Explain the cold chain concept and its importance for hides, skins, meat and vaccines • Describe refrigeration	Refrigerator, temperature data-logger, HACCP checklist templates	• Record temperature log of hides in storage over 48 hrs. • Identify cold-chain break points in a given scenario.	Guide students to: • Record temperature log of hides in storage over	Lecture; demonstration with thermometers and data loggers

	data-logging and transport refrigeration. 9.3 Outline HACCP principles as applied to animal product storage. 9.4 Explain last-mile cold chain challenges in Nigeria.	equipment, temperature data-logging and transport refrigeration • Outline HACCP principles as applied to animal product storage • Explain last-mile cold chain challenges in Nigeria			48 hrs • Identify cold-chain break points in a given scenario	
General Objective 10.0: Understand basic entrepreneurship and value-chain principles to the hides, skin and leather enterprise.						
14-15	10.1 Explain the hides and skin value chain from farm to finished leather goods. 10.2 Describe basic business-plan canvassing for a hides and skin enterprise. 10.3 Explain agribusiness finance, livestock insurance and off-take contracts. 10.4 Discuss digital and social-media marketing channels for leather products.	• Explain the hides and skin value chain from farm to finished leather goods • Describe basic business-plan canvassing for a hides and skin enterprise • Explain agribusiness finance, livestock insurance and off-take contracts • Discuss digital and social-media marketing channels for leather products	Business-plan template, internet access, sample off-take contracts	• Develop a one-page business plan for a micro hides-and-skin enterprise. • Present business plan to the class for peer assessment.	Guide students to: • Develop a one-page business plan for a micro hides-and-skin enterprise; • Present to class for peer assessment	Lecture; seminar presentation by students; guest speaker (tannery operator)

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

LIVESTOCK EXTENSION METHODS

PROGRAMME: HIGHER NATIONAL DIPLOMA (HND) ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: LIVESTOCK EXTENSION METHODS	**COURSE CODE: APT 416**	**CONTACT HOURS: 3 HOURS/WEEK**
	CREDIT UNIT: 3	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: I	**PRE-REQUISITE:**	**PRACTICAL: 2 HOURS/WEEK**
GOAL: This course is designed to provide the students with Knowledge and Skill of new innovations in livestock to rural dwellers		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know various steps involved in communication process; 2.0 Know the concept of mass communication; 3.0 Understand the theory of group dynamics; 4.0 Know the different methods of extension teaching and the role of extension worker; 5.0 Know the importance result and method demonstration; 6.0 Know the importance of audio-visual aids in extension teaching; 7.0 Know how to make simple teaching materials and equipment in the laboratory; 8.0 Know leadership systems within the village.		

PROGRAMME: HIGHER NATIONAL DIPLOMA (HND) ANIMAL PRODUCTION TECHNOLOGY						
COURSE TITLE: LIVESTOCK EXTENSION METHODS		**COURSE CODE: APT 416**		**CONTACT HOURS: 3 HOURS/WEEK**		
		CREDIT UNIT: 3		**THEORETICAL: 1 HOUR/WEEK**		
YEAR: II SEMESTER I		**PRE-REQUISITE:**		**PRACTICAL: 2 HOURS/WEEK**		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide the students with Knowledge and Skill of new innovations in livestock to rural dwellers						
GENERAL OBJECTIVE 1.0 Know various steps involved in communication process						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1-2	1.1 Describe the steps Involved in communication process. 1.2 Describe the methods and materials employed in communication. 1.3 Describe the methods used to motivate rural people. 1.4 Describe communication Principles (S-M-C-R method). 1.5 Recognize the need for clarity in presentation to enhance acceptance of ideas. 1.6 Explain why and	• Explain the steps involved in communication process • Explain the methods and materials employed in communication • Explain the methods used to motivate rural people • Explain communication principles (S-M-C-R method) • State the importance of clarity in presentation to enhance acceptance of ideas • State why and how adults learn	Lecture notes, Textbooks Duster Computer Audiovisual aids	• Identify methods and materials employed in communication. • Identify the methods used to motivate rural people. • Apply communication principles (S-M-C-R method). • Identify some of the natural tendencies related to learning.	• Demonstrate the methods and materials employed in communication • Show materials employed in communication • Demonstrate the methods used to motivate rural people Demonstrate the application of communication principles (S-M-C-R method) • Demonstrate some of the natural tendencies related to learning to student	Radio, Laptop, Handset phone, slide projector, Drama, Students

	how adults learn. 1.7 Explain how farmers learn new facts to improve livestock farming practices. 1.8 Describe some natural tendencies related to learning.	• Describe how farmers learn new facts to improve livestock farming practices • Explain the natural tendencies related to learning				
General Objective 2.0: Know the concept of mass communication						
3-4	2.1 Explain the concept and need for Mass Communication. 2.2 Define the various concepts of Mass Communication. 2.3 Discuss basic Mass Communication theories. 2.4 State various models of Mass Communication.	• Describe the concept and need for Mass Communication • Explain the concepts and basic Mass Communication theories. • Explain various models of Mass Communication	Lecture notes Textbooks Learning White board Marker pen Duster	• Identify various models of Mass Communication.	• Show models of Mass Communication	Photographs, videos
General Objective 3.0: Understand the theory of group dynamics						
5-6	3.1 Explain group dynamics 3.2 Describe the three basic parts of the group process 3.3 Explain the main factors that disrupt group action	• Explain group dynamics • Explain the three basic parts of the group process • Explain the main factors that disrupt group action	Lecture notes Textbooks Computer Audiovisual aids	• Carry out the process of group formation • Identify the main factors that disrupt group action	• Guide students ingroup formation etc. • Demonstrate the main factors that disrupt group action	
General Objective 4.0: Know different methods of extension teaching and the role of extension worker						

7-8	4.1Classify extension methods into three groups on the basis of the number of people involved. 4.2 Compare and contrast the three different methods used in 4.1. 4.3 Differentiate extension teaching from learning. 4.4 Explain extension as an act of helping someone else in his efforts to change himself. 4.5 Explain learning in relation to teaching role of the extension worker and learner. 4.6 Explain learning as an active process on the part of learner. 4.7 Describe the role of the personal influence of the extension worker as avital force in securing cooperation.	• Explain the classification process of extension methods into three groups on the basis of the number of people involved • Explain the different methods of extension teaching • Explain the differences between extension teaching and learning • Describe the role of extension worker as a facilitator and a change agent • Relate learning to teaching • Discuss learning as an active process on the part of learner • Explain the role of personal influence of the extension worker as avital force in securing cooperation	Lecture notes Audiovisual aids Textbooks Internets			
General Objective 5.0: Know the importance result and method demonstration						
9	5.1 Explain the difference between	• Differentiate between method and	Conducive environment	• Demonstrate the procedure for	• Guide students in conducting livestock	Students PAS

	method and result demonstration. 5.2 Describe the steps in conducting method demonstration. 5.3 Describe the steps in result demonstration.	result demonstration • Explain the steps in conducting method and result demonstration	Audio-visual aids	method. • Role-play.	show • Role-play	
General Objective 6.0: Know the importance of audio-visual aids in extension teaching						
10-11	6.1 Describe all audio visuals used in extension work e.g public address systems, overhead projectors, camera, slide projector etc. 6.2 Describe the operation of the audiovisual equipment in 6.1 above. 6.3 Describe the maintenance of the audiovisual equipment in 6.1. 6.4 Describe the planning and maintenance of an audiovisual studio. 6.5 Explain the advantages of different types of audiovisual aids in extension work.	• Explain all audio visuals used in extension work e.g public address systems, overhead projectors, camera, slide projector, etc • Explain the operation and maintenance of audiovisual equipmentin6.1 • Explain the planning and maintenance of an audiovisual studio • Discuss the advantages of different types of audiovisual aids in extension work • Explain the differences between the audiovisual aids • Explain the ICT	Lecture notes public address systems overhead projectors camera slide projector, etc Audiovisual studio VSAT, routers/switch es, PCs, radio/antennae, GSM, GPS, GIS Drones (UAV), etc.	• Operate the audiovisual equipment in 6.1above. • Carry out the maintenance of the audiovisual equipment in 6.1above. • Carry out the planning of an audiovisual studio. • Carry out the maintenance of an audiovisual studio. • Identify ICT based livestock extension. • Service delivery such as VSAT, • routers/switches, PCs, radio/antennae, GSM, GPS, GIS drones, (UAV), etc. • Apply VSAT, routers/switches,	Guide the students on the identification, • Use and maintenance of audiovisual aids and ICT facilities • Guide the students on the planning and maintenance of audiovisual studio • Guide the students on the dentification • and application of the equipment	TV, Slide projector, camera, overhead projector

	6.6 Differentiate between the audiovisual aids. 6.7 Describe ICT systems-based livestock extension service delivery such as VSAT, routers/switches, PCs, radio/antennae, GSM, GPS, GIS Drones (UAV), etc. 6.8 Describe the operation of the ICT equipment in 6.7 above. 6.9 Explain the application of the ICT equipment in livestock extension service delivery. 6.0 Explain the advantages of ICT facilities in extension work.	systems based agricultural extension service delivery Explain the operation of the ICT equipment • Describe the application of the ICT equipment in agricultural extension service delivery • Discuss the advantages of ICT facilities in livestock extension work		PCs, radio/antennae, GSM, GPS, GISDrones (UAV), etc in livestock extension service delivery.		
General Objective 7.0: Know how to make simple teaching materials and equipment in the laboratory						
12-13	7.1 Identify materials for making posters, bulletins etc. 7.2 Describe how to carryout freehand sketches of livestock products and sciences.	• Describe materials for making posters, bulletins etc • Explain how to carry out freehand sketches of livestock products and sciences	Lecture notes Whiteboard Cardboard papers Markers Staplers Gums etc	• Identify materials for making teaching aids. • Carryout freehand sketches of various livestock products. • Construct simple teaching aids for	• Guides students to identify materials for making teaching aids and carryout freehand sketches of various livestock products • Guides students to	Teaching aid materials (cardboard paper, ribbon, masking/sellotape, Marker, Flip chart,etc Drawing lab/studio, computer

	7.3 Describe the Design of poster, bulletin, handbills, etc for extension work. 7.4 Describe the Planning and maintenance of a drawing laboratory. 7.5 Describe the display of poster, bulletin etc for Maximum effect.	• Explain the Design of poster, bulletin, handbills, etc for extension work • Explain the Planning and maintenance of a drawing laboratory • Explain the display of poster, bulletin etc for Maximumeffect	Posters bulletins Drawing studio	extension work. • Design poster, • Bulletin, handbills, etc for extension work. • Plan and maintain a drawing laboratory. • Display poster, bulletin etc for Maximum effect.	design poster, bulletin, handbills, etc • for extension work • Guide students to plan and maintain a drawing laboratory • Guide students to display poster, • Bulletin etc for Maximum effect	
GeneralObjective:8.0 Know leadership systems within the village						
14-15	8.1 Explain the different types of village organization and their leadership structure. 8.2 Explain the power structure of a typical rural area. 8.3List the leadership qualities that may enhance the success of extension work Identifying effective leadership. 8.4 Explain how to identify an effective leader to assist in extension work in a rural setting.	• Discuss the different types of village organization and their leadership structure • Discuss the power structure of atypical rural area • Explain the leadership qualities that may enhance the success of extension work • Explain how to identify an effective leader to assist in extension work in a rural setting • Explain the	Classroom. Model village.	• Identify the different types of village organization and their leadership structure in rural setting. • Analyze the power structure existing in the rural area. • Identify effective leaders for effective teaching in rural area.	Guide students to: • Identify the different types of village organization and their leadership structure in rural setting • Analyze the power structure existing in the rural area. Identify effective leaders for effective teaching in rural area.	Model village community Students, vehicle

	8.5 State the role of a leader as an important vehicle to speed up the acceptance of innovation.	leadership qualities required of an extension worker				

Course Assessment:

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



BEEF CATTLE PRODUCTION

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: BEEF CATTLE PRODUCTION	**COURSE CODE: APT 417**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
GOAL: The course is designed to acquaint the students with all aspects of beef cattle Production and Management.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the history and development of beef cattle industry on Nigeria; 2.0 Know the classification and breeds of beef cattle; 3.0 Know performance characteristics and evaluation of beef cattle; 4.0 Know the management systems of beef cattle; 5.0 Understand reproduction in Beef Cattle; 6.0 Understand beef cattle Health Care; 7.0 Know the marketing and transportation of beef cattle; 8.0 Know how to slaughter and Process beef cattle.		

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY						
COURSE TITLE: BEEF CATTLE PRODUCTION		**COURSE CODE: APT 417**		**CONTACT HOURS: 4 HOURS/WEEK**		
		CREDIT UNIT: 4		**THEORETICAL: 1 HOUR/WEEK**		
Year: II Semester: II		**PRE-REQUISITE:**		**PRACTICAL: 3 HOURS/WEEK**		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: The course is designed to acquaint the students with all aspects of beef cattle Production and Management						
GENERAL OBJECTIVE 1.0: Know the history and development of beef cattle industry on Nigeria						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Outline the origin and development of beef cattle industry in Nigeria. 1.2 Explain the importance of beef cattle industry on Nigeria economy. 1.3 Explain using the map of Nigeria the state-by-state distribution of beef cattle. 1.4 List factors favorable and unfavorable to beef cattle production in Nigeria.	• Explain the origin and development of beef cattle industry in Nigeria. • Discuss the importance of beef cattle industry on Nigeria economy. • Illustrate using the map of Nigeria the state-by-state distribution of beef cattle • Enumerate factors favorable and unfavorable to beef cattle production in Nigeria e.g effect of tse tse fly ,Rinderpest etc.	Lecturer assisted assignments. Students to study maps of cattle distribution in Nigeria, Grade given assignments	• Use map of Nigeria the state-by-state distribution of beef cattle. • Identify factors favorable and unfavorable to beef cattle production in Nigeria e.g effect of tse tse fly, Rinderpest etc.	Guide Students to • Use map of Nigeria the state-by-state distribution of beef cattle • Identify factors favorable and unfavorable to beef cattle production in Nigeria e.g effect of tse tse fly, Rinderpest etc.	Lecturer assisted assignments. Students to study maps of cattle distribution in Nigeria, Chart /Map showing cattle distribution in Nigeria.
General Objective 2.0: Know the classification and breeds of beef cattle						
2-3	2.1 Outline the breeds of beef cattle into i. Temperate or exotic breeds	• Explain the breeds of beef cattle into ➢ Temperate or exotic breeds	Lecturer Assist students to identify breed	• Identify beef cattle breeds commonly reared in Nigeria and other parts of the	• Identify beef cattle breeds commonly reared in	Lecturer Assist students to identify

	ii. Tropical or indigenous breeds. 2.2 Describe some important common breeds found in the tropical and temperate region of the world and identify their distinctive characteristics. 2.3 Describe the conformation and structure of a typical beef cattle with properly labeled diagram. 2.4 Explain the various factors to be considered in establishing a beef herd. 2.5 Explain the factors to be considered on selecting beef cattle. 2.6 Describe types and methods of beef cattle selection. 2.7 Explain genetic effects of pedigree, individual and family selections with their advantages and disadvantages. 2.8 Describe the followings: i. Bull ii. Steer iii. Stag iv. Cow	➢ Tropical or indigenous breeds • Describe some important common breeds found in the tropical and temperate region of the world and identify their distinctive characteristics • Explain the conformation and structure of a typical beef cattle with properly labeled diagram • Explain the various factors to be considered in establishing a beef herd. • Explain the factors to be considered on selecting beef cattle. • Describe types and methods of beef cattle selection. • Explain genetic effects of pedigree, individual and family selections with their advantages and disadvantages. • Describe the followings: ➢ Bull ➢ Steer ➢ Stag ➢ Cow ➢ Heifer ➢ Calf ➢ Yearling	characteristics in Beef cattle.	world. • Compare body size, coat colour, horn type, and conformation of various beef cattle breeds. • Demonstrate proper handling and restraint techniques during breed identification. • Assess the suitability of different beef cattle breeds for meat production.	Nigeria and other parts of the world. • Compare body size, coat colour, horn type, and conformation of various beef cattle breeds. • Demonstrate proper handling and restraint techniques during breed identification. • Assess the suitability of different beef cattle breeds for meat production.	breed characteristics in Beef cattle.

	v. Heifer vi. Calf vii. Yearling viii. Classify cattle based on use ix. stocker cattle x. Feeder cattle xi. Slaughter cattle xii. Draught cattle	➢ Classify cattle based on use ➢ stocker cattle ➢ Feeder cattle ➢ Slaughter cattle ➢ Draught cattle				
General Objective 3.0: Know performance characteristics and evaluation of beef cattle						
4-5	3.1 Explain the major breeds of beef cattle and their characteristics. 3.2 Explain factors affecting growth and productivity in beef cattle. 3.3 Explain methods used in evaluating beef cattle performance. 3.4 Differentiate between productive and reproductive performance traits in beef cattle. 3.5 Explain feed conversion efficiency and growth rate in beef cattle production. 3.6 Explain fertility, service conception calving rate, or calf crop, calving interval, service period or days open. 3.7 Explain non-rectum rate,	• Explain the major breeds of beef cattle and their characteristics. • Discuss factors affecting growth and productivity in beef cattle. • Explain methods used in evaluating beef cattle performance. • Differentiate between productive and reproductive performance traits in beef cattle. • Explain feed conversion efficiency and growth rate in beef cattle production. • Explain fertility, service conception calving rate, or calf crop, calving interval, service period or days open. • Explain non-rectum rate,	Lecture notes. Farm records	• Identify common breeds of beef cattle using pictures or live animals. • Record physical characteristics of beef cattle. • Measure body weight using weighing scale or heart girth tape. • Determine body condition score (BCS) of selected cattle. • Calculate average daily weight gain of beef cattle. • Examine feed intake and feed conversion ratio in beef cattle. • Visit a cattle farm or ranch to observe beef cattle management	• Identify common breeds of beef cattle using pictures or live animals. • Observe and record physical characteristics of beef cattle. • Measure body weight using weighing scale or heart girth tape. • Determine body condition score (BCS) of selected cattle. • Calculate average daily weight gain of beef cattle. • Examine feed intake and feed	Slides Chart

	birth weight, growth weaning, weight, fattening performance, productivity performance.	birth weight, growth weaning, weight, fattening performance, productivity performance.		practices.	conversion ratio in beef cattle. • Visit a cattle farm or ranch to observe beef cattle management practices.	
General Objective 4.0: Know the management systems of beef cattle						
6-7	4.1 Describe the intensive and extensive systems of beef cattle management. 4.2 Describe the systems of beef cattle production. 4.3 Describe the functions and uses of paddocks, road, feed bunks, water troughs, handling area, crounding area, shoute or alley, squeeze shoute. Weigh bridger, spray race, dips, shelters, silo etc in beef cattle production. 4.4 Describe activities on beef cattle. 4.5 Explain bedding of calve houses and sheds and manure handling. 4.6 State the nutrient requirement of beef cattle. 4.7 Explain the importance of feeding silage hay to	• Describe the intensive and extensive systems of beef cattle management. • Describe the following systems of beef cattle production: - ➢ Raising breeding stock ➢ Cow calf operation ➢ Growing of stockers ➢ Baby beef production ➢ Cattle fattening and finishing ➢ Dual purpose production system • Describe the functions and uses of paddocks, road, feed bunks, water troughs, handling area, crounding area, shoute or alley, squeeze shoute. Weigh bridger, spray race, dips, shelters, silo etc in beef cattle	Lecture Design a model beef cattle house, Grade model designed by students Identify beef cattle by marking Brand ear notch and ear tag beef cattle Demonstration Demonstrate silage preparation and hay making	• Identify different classes of beef cattle breeds and management systems. • Visit a cattle farm to observe extensive, semi-intensive or intensive management practices. • Demonstrate feeding and watering of beef cattle using appropriate materials and equipment. • Carry out routine cleaning and sanitation of cattle housing facilities.	• Identify and classify different beef cattle breeds and management systems. • Visit a cattle farm to observe extensive, semi-intensive or intensive management practices. • Demonstrate feeding and watering of beef cattle using appropriate materials and equipment. • Carry out routine cleaning	Paddocks, alley, weigh bride, spray, race, dips etc.- Ear Notch

	beef cattle.	production. • Describe the following activities on beef cattle: - deworming, hoof trimming, spraying/dipping. Castration, and their advantages • Explain bedding of calve houses and sheds and manure handling • State the nutrient requirement of beef cattle • Explain the importance of feeding silage hay to beef cattle.		• Identify common cattle diseases, parasites and preventive measures. • Demonstrate vaccination, deworming and basic cattle handling procedures. • Prepare simple feed rations for beef cattle.	and sanitation of cattle housing facilities. • Identify common cattle diseases, parasites and preventive measures. • Demonstrate vaccination, deworming and basic cattle handling procedures. Prepare simple feed rations for beef cattle.	
General Objective 5.0: **Understand reproduction in Beef Cattle**						
8-9	5.1 Explain the following: - i. Age at puberty ii. Heat period in cow/heifer iii. Signs of heat iv. Age to breed heifers v. Time of breeding vi. Mating methods vii. Gestation period viii. Pregnancy diagnosis/testing ix. Care of pregnant	• Explain the following: - ➢ Age at puberty ➢ Heat period in cow/heifer ➢ Signs of heat ➢ Age to breed heifers ➢ Time of breeding ➢ Mating methods ➢ Gestation period ➢ Pregnancy diagnosis/testing ➢ Care of pregnant	Identify cows on heat and mate them naturally or by Artificial Insemination Identify symptoms of pregnancy in cows and/or heat refit Artificial Insemination	• Identify male and female reproductive organs in cattle using charts, models, or specimen samples. • Identify heat signs in cows and heifers. • Demonstrate heat detection methods and record	• Identify male and female reproductive organs in cattle using charts, models, or specimen samples. • Observation and identify heat signs in cows and heifers.	Artificial Insemination kits Model Specimen Slides Charts

	cow x. Care of the new born calf xi. Mating ratio xii. Age to breed bulls 5.2 Outline the stages of the reproductive cycle in cows and heifers. 5.3 Explain the signs of heat (oestrus) in beef cattle. 5.4 Explain the process of mating, fertilization, gestation, and calving in beef cattle. 5.5 Differentiate between natural mating and artificial insemination in beef cattle production. 5.6 Explain factors affecting fertility and reproductive performance in beef cattle. 5.7 Describe pregnancy diagnosis and care of pregnant cows.	cow ➢ Care of the new born calf ➢ Mating ratio ➢ Age to breed bulls • Explain the stages of the reproductive cycle in cows and heifers. • Explain the signs of heat (oestrus) in beef cattle. • Discuss the process of mating, fertilization, gestation, and calving in beef cattle. • Differentiate between natural mating and artificial insemination in beef cattle production. • Explain factors affecting fertility and reproductive performance in beef cattle. • Describe pregnancy diagnosis and care of pregnant cows.	kits Model Specimen Slides	keeping. • Demonstrate natural mating practices in beef cattle farms. • Observe artificial insemination procedures and equipment. • Identification and handling of reproductive management tools and materials. • Demonstrate pregnancy detection techniques under supervision. • Observe calving process and care of newborn calves. • Undertake farm visit to observe reproductive management practices in beef cattle production.	• Demonstrate heat detection methods and record keeping. • Demonstrate natural mating practices in beef cattle farms. • Observe artificial insemination procedures and equipment. • Identification and handling of reproductive management tools and materials. • Demonstrate pregnancy detection techniques under supervision. • Observe calving process and care of newborn calves. • Farm visit to observe reproductive	

					management practices in beef cattle production.	
General Objective 6.0 **Understand beef cattle Health Care**						
10-12	6.1 Describe the symptoms of the main beef cattle diseases in Nigeria. 6.2 Explain the life cycle of common endo and ectoparasites affecting beef cattle and how to control them. 6.3 Discuss nutritional practices that promote healthy beef cattle. 6.4 Explain methods of detecting sick animals in a herd. 6.5 Explain the use of disinfectant and fumigants and their hazards.	• Describe the symptoms of the main beef cattle diseases in Nigeria • Explain the life cycle of common endo and ectoparasites affecting beef cattle and how to control them. • Discuss nutritional practices that promote healthy beef cattle. • Explain methods of detecting sick animals in a herd. • Explain the use of disinfectant and fumigants and their hazards.	Measure pulse rate, breathing rate and record each parameter in beef cattle	• Demonstrate cattle vaccination procedures. • Practice deworming of cattle using appropriate materials. • Identify external and internal parasites affecting beef cattle. • Demonstrate cattle handling and restraint methods. • Clean cattle housing and equipment. • Prepare simple health records for beef cattle. • Inspect feeds and water sources for cattle hygiene. • Visit a cattle farm or veterinary clinic to observe health	• Demonstrate cattle vaccination procedures. • Practice deworming of cattle using appropriate materials. • Identify of external and internal parasites affecting beef cattle. • Demonstrate cattle handling and restraint methods. • Clean cattle housing and equipment. • Preparation of simple health records for beef cattle. • Inspect feeds	Microscopes Slides Syringes/needles Gloves Diagnosis kits

				management practices.	and water sources for cattle hygiene. • Visit to a cattle farm or veterinary clinic for observation of health management practices.	
General Objective 7.0: Know the marketing and transportation of beef cattle						
13-15	7.1 Explain the importance of beef cattle marketing. 7.2 Outline the channels involved in beef cattle marketing. 7.3 Explain the roles of cattle dealers, marketers, transporters, and consumers in the beef cattle trade. 7.4 Explain the procedures involved in pricing and sales of beef cattle. 7.5 Outline factors affecting beef cattle marketing and transportation. 7.6 Explain the methods of transporting beef cattle by road, rail, and water. 7.7 Explain the handling and welfare requirements of	• Explain the importance of beef cattle marketing. • Identify the channels involved in beef cattle marketing. • Discuss the roles of cattle dealers, marketers, transporters, and consumers in the beef cattle trade. • Explain the procedures involved in pricing and sales of beef cattle. • Identify factors affecting beef cattle marketing and transportation. • Discuss the methods of transporting beef cattle by road, rail, and water. • Explain the handling and	Lecture and field trips Grade logbooks	• Record cattle pricing methods in livestock markets. • Demonstrate weighing and valuation of beef cattle. • Carry out identification of transportation facilities used for cattle movement. • Demonstrate proper loading and unloading techniques for beef cattle. • Practice handling	• Recording cattle pricing methods in livestock markets. • Demonstrate weighing and valuation of beef cattle. • Carry out identification of transportation facilities used for cattle movement. • Demonstrate of proper loading and unloading techniques for beef cattle.	Charts and pictures

	cattle during transportation. 7.8 Outline common challenges associated with beef cattle transportation. 7.9 Explain the importance of veterinary inspection and documentation during transportation. 7.10 Explain methods of marketing beef cattle 7.1 Explain transportation of beef cattle selling or slaughtering	welfare requirements of cattle during transportation. • Explain common challenges associated with beef cattle transportation. • Explain the importance of veterinary inspection and documentation during transportation. • Explain methods of marketing beef cattle, i.e., Terminal public markets, livestock auction markets, country selling. • Explain transportation of beef cattle selling or slaughtering		and restraining of cattle before transportation. • Prepare vehicles used for transporting cattle. • Identify signs of stress and injuries in transported cattle. • Demonstrate sanitary and safety practices during cattle transportation.	• Practice handling and restraining of cattle before transportation. • Prepare vehicles used for transporting cattle. • Identify signs of stress and injuries in transported cattle. • Demonstrate sanitary and safety practices during cattle transportation	

Course Assessment:

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



YEAR II SEMESTER II

APPLIED ANIMAL NUTRITION

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: APPLIED ANIMAL NUTRITION	**COURSE CODE: APT 421**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
GOAL: This course is designed to introduce students to the general principles and mechanism of feeds/nutrients utilisation in farm animals.		

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

1.0 Know feed ingredients used in rations for farm animals;
2.0 Know the non-nutrient feed additives used in rations for farm animals;
3.0 Know the importance of agro-industrial by-products as feed ingredients in animal rations;
4.0 Understand the methods of processing farm animal feeds;
5.0 Know the methods of evaluation of the nutritive value of feeds;
6.0 Know the techniques of formulating farm animal rations;
7.0 Know how to feed different classes of farm animals;
8.0 Know the methods of analysis of animal feeds;
9.0 Know the different anti-nutritional properties in some animal feeds;
10.0 Know how to apply computer-aided feed formulation software (Allix, AFOS, Best Mix, Excel) for least-cost ration design;
11.0 Understand Management of mycotoxin contamination and feed-safety at commercial feed mill level;
12.0 Understand the operation and management of feed mill.

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: APPLIED ANIMAL NUTRITION	**COURSE CODE: APT 421**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: This course is designed to introduce students to the general principles and mechanism of feeds/nutrients utilisation in farm animals.		
GENERAL OBJECTIVE 1.0: Know feed ingredients used in rations for farm animals.		

THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Define feeds, feed ingredients and feedstuffs. 1.2 Explain the relationship between feed ingredients and nutrients. 1.3 Explain feed ingredients used in compounding animal rations. 1.4 Describe roughages and 1.5 Outline feed ingredients into roughages, concentrates, mineral sources and vitamin supplements. 1.6 Differentiate	• Explain feeds, feed ingredients and feedstuffs. • Explain the relationship between feed ingredients and nutrients. • Discuss feed ingredients used in compounding animal rations. • Describe roughages and concentrates. • Discuss the classification feed ingredients into roughages, concentrates, mineral sources and vitamin supplements.	Charts, feed ingredient samples Whiteboard Marker Computer system Internet	• Identify 10 common feed ingredients, sort into roughages and concentrates. • Record Total Digestible Nutrients (TDN) values.	Guide students to: • Identify 10 common feed ingredients, sort into roughages and concentrates • Record Total Digestible Nutrients (TDN) values.	Feed ingredient samples nutritive value tables PPE Whiteboard Marker Computer system Internet Facemask

	between protein and carbohydrate concentrates. 1.7 List the approximate TDN and energy value of each feed ingredient for farm animals.	• Differentiate between protein and carbohydrate concentrates. • Explain the approximate TDN and energy value of each feed ingredient for monogastric and ruminant animals				
General Objective 2.0: Know the non-nutrient feed additives used in rations for farm animals.						
2	2.1 Define feed additives. 2.2 Explain feed additives and their functions. 2.3 Explain the residual effects of feed additives on farm animals and their products.	• Explain feed additives. • Discuss feed additives and their functions (antibiotics, probiotics, growth promoters, feed binders, etc.). • Discuss the residual effects of feed additives on farm animals and their products.	Charts of feed additive, Nutritional charts Whiteboard Marker Computer system Internet	• Examine labels of commercial feed additive products. • Identify active ingredients. • Identify inclusion rates and withdrawal periods.	Guide student to: • Examine labels of commercial feed additive products • Identify active ingredients • Identify Inclusion rates and withdrawal periods	Commercial feed additive packs; magnifying glass; record sheets Computer system Internet
General Objective 3.0: Know the importance of agro-industrial by-products as feed ingredients in animal rations.						
3	3.1 Define agro-industrial by-products. 3.2 Explain agro-industrial by-products sources. 3.3 Outline common	• Explain agro-industrial by-products • Discuss agro-industrial by-products sources. • Enumerate	By-products, nutritive value tables Whiteboard Marker Computer system Internet	• Collect samples of 5 agro-industrial by-products. • Analyse and compare proximate composition. • Prepare cost–benefit table vs maize-soya	Guide student to: • Collect samples of 5 agro-industrial by-products • Analyse and compare proximate composition	By-product samples, proximate analysis tables, calculator, record sheets. Computer system

	agro-industrial by-products used in animal feeding showing plant or animal origin. 3.4 List advantages of agro-industrial by-products in animal feeds. 3.5 Describe how the by-products in 3.2 are processed. 3.6 Explain the nutritive value of agro-industrial by-products to farm animals. 3.7 Describe methods of improving the nutritive value of agro-industrial by-products.	common agro-industrial by-products used in animal feeding showing plant or animal origin. • Explain advantages of agro-industrial by-products in animal feeds. • Discuss how the by-products in 3.2 are processed. • Explain the nutritive value of agro-industrial by-products to farm animals. • Describe methods of improving the nutritive value of agro-industrial by-products (urea treatment, ensiling, fermentation).		diet.	• Prepare cost–benefit table vs maize-soya diet	Internet
General Objective 4.0: Understand the methods of processing farm animal feeds.						
4	4.1 Describe various methods of processing feeds and feed ingredients. 4.2 Explain the effects	• Describe various methods of processing feeds and feed ingredients: grinding, mixing, cooking, pelleting,	Feed mill, grinder, mixer and accessories Feed quality assurance Whiteboard,	• Operate a hammer mill. • Monitor mixing cycle. • Pellet a small batch. • Compare pellet quality (durability, uniformity) before and after	Guide students to: • Operate a hammer mill • Monitor mixing cycle • Pellet a small	Hammer mill, conveyor, mixer, pelletizer, dryer, weighing scale, sieve, empty bags, sewing

	of processing on the nutritive value of feed/ingredients. 4.3 Describe basic feed mill operations.	flaking, fermentation. • Explain the effects of processing on the nutritive value of feed/ingredients (concentrates and roughages). • Describe basic feed mill operations	Marker, Computer system Internet	cooling.	batch • Compare pellet quality (durability, uniformity) before and after cooling.	twine, PPE. Computer system Internet Marker Sticker
General Objective 5.0: Know the methods of evaluation of the nutritive value of feeds.						
5	5.1 Explain digestibility, its methods of determination and computation. 5.2 Describe the energy values of feed ingredients and feeds. 5.3 Explain the concept of partition of energy. 5.4 Explain protein quality.	• Explain digestibility, its methods of determination and computation. • Explain the energy values of feed ingredients and feeds. • Discuss the concept of partition of energy (GE, DE, ME, NE). • Discuss protein quality (biological value, PDCAAS, NPU).	Farm animals, Digestibility cages Sample tools Sample bags Whiteboard Marker Computer system Internet	• Conduct in-vitro digestibility experiment using rumen liquor. • Compute apparent digestibility for two feed ingredients. • Carryout total proximate analysis.	Guide students to: • Conduct in-vitro digestibility experiment using rumen liquor • Compute apparent digestibility for two feed ingredients. • Carryout total proximate analysis	Rumen liquor, filter paper, centrifuge, substrate, recording sheets Whiteboard Marker Computer system Internet
General Objective 6.0: Know the techniques of formulating farm animal rations.						
6	6.1 Explain ration and balancing. 6.2 List various methods of ration formulation.	• Explain ration and balancing. • List various methods of ration formulation.	Nutrition value tables, Calculators Whiteboard Marker	• Formulate a 3-ingredient layer ration by Pearson's square and algebraic method.	Guide students to: • Formulate a 3-ingredient layer ration by Pearson's	Nutritive value tables, calculators, worksheets, NRC standards

	6.3 Discuss ration formulation. 6.4 Explain rations for different species and classes using more than two ingredients.	• Discuss ration formulation using: ➢ pearson's square ➢ algebraic method ➢ trial-and-error • Explain rations for different species and classes using more than two ingredients; check for accuracy.	Computer system Internet	• Verify nutrient profile against National Research Council (NRC) standards.	square and algebraic method • Verify nutrient Profile against National Research Council (NRC) standards.	Computer system Internet
General Objective 7.0: Know how to feed different classes of farm animals						
7	7.1 Describe different methods of feeding 7.2 Describe different feeding systems 7.3 Explain precautionary measures when preparing and offering feeds under various conditions and at different ages. 7.4 Explain the calculation of feed intake of farm animals at different body weights.	• Describe different methods of feeding (restricted and ad libitum). • Describe different feeding systems (creep feeding, stall feeding, etc.). • Discuss precautionary measures when preparing and offering feeds under various conditions and at different ages. • Discuss the calculation of feed intake of farm animals at different body weights.	Weighing balance, feeds, farm animals Whiteboard Marker Computer system Internet	• Set up restricted and ad-libitum feeding trials for broilers over 5 days • Record intake • Calculate Body weight (BW) and Feed Conversion Ratio (FCR) compare.	Guide students to: • Set up restricted and ad-libitum feeding trials for broilers over 5 days • Record intake • Calculate Body weight (BW) and Feed Conversion Ratio (FCR) compare.	Broilers, feed, weighing scale, drinkers, feeders, record sheets Calculator Computer system Internet
General Objective 8.0: Know the methods of analysis of animal feeds						

8	8.1 Explain proximate analysis of feeds. 8.2 Explain silage pH. 8.3 Explain silage proximate. 8.4 Explain volatile fatty acids in rumen liquor determination.	• Discuss proximate analysis of feeds. • Analyse animal feeds for: moisture/dry matter, ash, crude protein, crude fibre, ether extract, gross energy, minerals (Ca, P). • Explain silage pH. • Explain silage proximate • Discuss volatile fatty acids in rumen liquor.	Kjeldahl digestion/distillation apparatus, Kjeldahl flask, Soxhlet apparatus, oven; muffle furnace; weighing balance; AAS/flame photometer/colorimeter.	• Perform proximate analysis (moisture, crude protein, crude fibre, ether extract, ash) on maize and groundnut cake samples. • Tabulate results.	• Guide students to: • Perform proximate analysis (moisture, crude protein, crude fibre, ether extract, ash) on feed ingredients, • Summarize the results (tables, charts graphs etc).	Kjeldahl apparatus; Soxhlet apparatus; oven, muffle furnace, weighing balance, reagents, feed ingredients, record sheets. Whiteboard Marker Computer system Internet
General Objective 9.0: Know the different anti-nutritional properties in some animal feeds.						
9-10	9.1 Explain toxicants and other anti-nutritional factors. 9.2 Describe methods of detoxification. 9.3 Explain nutrient toxicity.	• Explain toxicants and other anti-nutritional factors (trypsin inhibitors, tannins, phytates, gossypol, HCN, aflatoxins). • Describe methods of detoxification (heat treatment, solvent extraction, fermentation, soaking). • Explain nutrient toxicity: causes, toxic levels,	Charts, reference textbooks Whiteboard Marker Computer system Internet .	• Conduct aflatoxin screening of stored feed ingredients using rapid test kits. • Record results.	Guide student to: • Conduct aflatoxin screening of stored feed ingredients using rapid test kits; record results; discuss safe threshold levels.	Feed ingredients (fresh and stored); aflatoxin rapid test kits; recording sheets. Computer system Internet

		symptoms and effects.				
Objective 10.0: Know how to apply computer-aided feed formulation software (Allix, AFOS, Best Mix, Excel) for least-cost ration design						
11-12	10.1 Explain least-cost feed formulation and its economic importance. 10.2 Identify software. 10.3 Describe the workflow, run optimisation, interpret output. 10.4 Explain validation of computer-generated rations: nutrient checks, ingredient feasibility, cost verification. 10.5 Explain quality assurance of software-formulated feeds. 10.6 Explain different classes of feed ingredients.	• Explain least-cost feed formulation and its economic importance. • Explain software packages: Allix, AFOS, Best Mix and Microsoft Excel. • Describe the workflow: enter ingredient database, nutrient requirements, constraints, ingredient costs, run optimisation, interpret output. • Explain validation of computer-generated rations: nutrient checks, ingredient feasibility, cost verification. • Discuss quality assurance of software-formulated feeds (inclusion limits, anti-nutritional factor constraints).	Computers/laptops, projector, Allix/AFOS licence or Excel least-cost template; ingredient cost database, printer Feed ingredients	• Identify feed ingredients. • Use Excel (or Allix) to formulate least-cost broiler grower and layer ration. • Compare cost per ton with manual Pearson's square output. • Present findings.	Guide students to: • Identify feed ingredients • Use Excel (or Allix) to formulate least-cost broiler grower and layer rations • Compare cost per ton with manual Pearson's square output • Present findings.	Computers, Excel feed formulation template or Allix demo, projector, printer, cost data tables, Feed ingredients

		• Discuss different classes of feed ingredients				
General Objective 11.0: Understand Management of mycotoxin contamination and feed-safety at commercial feedmill level						
13-14	11.1 Outline mycotoxin contamination of Nigerian feeds. 11.2 Describe contamination pathways. 11.3 Explain clinical effects. 11.4 Discuss Nigerian regulatory framework. 11.5 Outline economic impact. 11.6 Describe mycotoxin screening methods. 11.7 Outline rapid LFA strip-test interpretation. 11.8 Describe mycotoxin binders. 11.9 Explain Good Manufacturing Practices at	• Outline major mycotoxins. • Describe contamination pathways. • Explain clinical effects. • Discuss Nigerian regulatory framework. • Outline economic impact. Describe mycotoxin screening methods. • Outline LFA interpretation. • Describe mycotoxin binders. • Explain GMP at feed-mill. • Describe HACCP for feed-mill.	Mycotoxin classification charts, NAFDAC/SON regulatory documents, PACA framework documents, Aflatoxin case-study materials, LFA strip-test kits, ELISA equipment information, Mycotoxin binder samples, GMP/HACCP template.	• Identify mycotoxin-contaminated maize, groundnut and other feed grain samples by visual inspection. • Conduct feed-mill mycotoxin audit checklist on the institutional feed-mill. • Calculate aflatoxin compliance against NAFDAC limits using sample data. • Perform LFA strip tests for aflatoxin, fumonisin and DON on feed samples and interpret results. • Calculate optimal mycotoxin-binder inclusion rates for a contaminated feed batch. • Compose a complete feed-mill GMP/HACCP SOP for mycotoxin control. • Inspect a commercial	Guide students to: • Identify visual identification. • Conduct feed-mill audit. • Conduct compliance calculation. • Perform LFA strip-test procedure. • Calculate binder inclusion-rate. • Compose GMP/HACCP SOP. • Interpret commercial feed-mill inspection	Contaminated and clean grain samples, Audit checklist templates, NAFDAC limit charts, calculator, LFA test kits (aflatoxin, fumonisin, DON), Feed samples (contaminated and clean), Mycotoxin binder samples, GMP/HACCP SOP templates, Access to commercial feed-mill (visit).

	feed-mill level. 11.10 Describe HACCP for feed-mill operations.			feed-mill (where accessible) and provide mycotoxin-control recommendations.		
General Objective 12.0: Understand the operation and management of feedmill: layout, mixing technology, pellet quality control, mycotoxin screening, bagging and storage						
15	12.1 Describe feedmill layout. 12.2 Describe mixing technology. 12.3 Explain pellet quality control. 12.4 Describe mycotoxin screening methods and acceptable limits for poultry and ruminants. 12.5 Describe bagging procedures, labelling standards, storage conditions and operator safety (dust, noise, PPE). 12.6 Explain critical control points.	• Describe feedmill layout: receiving bay, raw material store, processing area, finished goods store, loading bay. • Describe mixing technology: types of mixers, mixing time, coefficient of variation. • Explain pellet quality control: pellet durability index (PDI), fines percentage, length and diameter. • Describe mycotoxin screening methods and acceptable limits for poultry and ruminants. • Describe bagging procedures, labelling standards, storage conditions	Feed mill equipment, mixer, pellet press, mycotoxin rapid test kits, PPE, safety signage. Whiteboard Marker Computer system Internet	• Visit feed mill. • Observe batch mixing cycle. • Collect pellet sample. • Measure PDI using shaker test. • Perform mycotoxin strip test on raw maize. • Prepare batch record sheet.	Guide student to: • Visit feed mill • Observe the process of batch feed production cycle (mash) • Pelletize mash feed and bagged • Measure PDI using shaker test • Perform mycotoxin test on the finished feed • Prepare batch record sheet.	Feedmill, pellet sample, PDI shaker, mycotoxin rapid test kit, batch record form; PPE. Feed ingredients Weighing scale

		and operator safety (dust, noise, PPE). • Explain critical control points				
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% **Total: 100%**						

FARM ANIMAL DISEASE

PROGRAMME: HIGHER NATIONAL DIPLOMA (HND) ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: FARM ANIMAL DISEASE	**COURSE CODE: APT 422**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: II	**PRE-REQUISITE: APT 411 FARM ANIMAL PARASITOLOGY**	**PRACTICAL: 3 HOURS/WEEK**
GOAL: This course is designed to equip students with advanced knowledge and practical skills in the prevention, recognition, investigation and control of infectious, nutritional, metabolic and management-related diseases affecting farm animals.		

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

1.0 Understand the concepts, classification, epidemiology, economics and regulatory framework of farm animal disease in Nigeria;
2.0 Understand farm-level disease investigation and diagnostic procedures;
3.0 Know the prevention and control of major bacterial diseases of cattle;
4.0 Know the prevention and control of major bacterial and viral diseases of small ruminants;
5.0 Know the prevention and control of major bacterial and viral diseases of pigs;
6.0 Know the prevention and control of major diseases of poultry;
7.0 Understand the management of nutritional, metabolic and toxic diseases in farm animals;
8.0 Understand integrated herd and flock health management practices;
9.0 Appreciate disease surveillance, outbreak reporting, One Health and animal health entrepreneurship.

PROGRAMME: HIGHER NATIONAL DIPLOMA (HND) ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: FARM ANIMAL DISEASE	**COURSE CODE: APT 422**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: II	**PRE-REQUISITE: APT 411 FARM ANIMAL PARASITOLOGY**	**PRACTICAL: 3 HOURS/WEEK**
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: This course is designed to equip students with advanced knowledge and practical skills in the prevention, recognition, investigation and control of infectious, nutritional, metabolic and management-related diseases affecting farm animals.		
GENERAL OBJECTIVE 1.0: Understand the concepts, classification, epidemiology, economics and regulatory framework of farm animal disease in Nigeria.		

THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Explain disease-related terminology and epidemiological concepts. 1.2 Explain the terms i. etiology, ii. pathogenesis, iii. prognosis, iv. morbidity, v. mortality case vi. fatality and vii. lethality. 1.3 Outline diseases.	• Define disease, health, illness, sub-clinical disease, clinical disease, syndrome, epizootic, enzootic, sporadic and pandemic. • Discuss classification and transmission of farm animal diseases.	Whiteboard, markers, projector, charts of disease classification. Lecture notes, reference textbooks Internet, video clips.	• Identify potential disease-risk factors within the institutional farm environment. • Assess farm biosecurity measures using a standard checklist. • Review farm mortality and morbidity records and calculate basic	Guide students to: • Tour the institutional farm. • Conduct a herd-health audit. • Visit veterinary clinic/NVRI office. • Review mortality records. • Compute morbidity/mortality. • Develop a disease-risk report.	Institutional farm. Herd-health audit checklist. Mortality/disease records. Calculator, Transport facilities. Computer system and printer

	1.4 Outline the disease triad. 1.5 Explain principles of disease epidemiology including incidence, prevalence, morbidity, mortality and outbreak investigation. 1.6 Explain the economic and public-health importance of farm animal diseases in Nigeria, including production losses, reproductive losses, mortality, treatment costs, carcass condemnation and zoonotic risks. 1.7 Explain the role of the animal-production technologist in disease prevention, herd-health management, farm sanitation, disease reporting and veterinary support services. 1.8 Outline the major veterinary and regulatory	• Explain the economic and public-health importance of livestock diseases. • Discuss the responsibilities of animal-production technologists in herd-health management. • Explain the functions of veterinary and regulatory institutions involved in animal-health management in Nigeria.		disease indices. • Visit a veterinary clinic or livestock-health facility and document the services provided. • Develop a one-page report on the disease-risk profile of the institutional farm.		PPE.

	institutions involved in animal-disease control and livestock health management in Nigeria.					
GENERAL OBJECTIVE 2.0: Understand farm-level disease investigation and diagnostic procedures						
2	2.1 Explain systematic disease-investigation procedures. 2.2 Explain history-taking and clinical examination techniques. 2.3 Explain normal physiological parameters in farm animals. 2.4 Explain proper sample collection and handling procedures. 2.5 Explain field diagnostic procedures and necropsy techniques. 2.6 Explain proper labeling, preservation and transportation of samples.	• Explain systematic disease-investigation procedures. • Explain history-taking and clinical examination techniques. • Discuss normal physiological parameters in farm animals. • Explain proper sample collection and handling procedures. • Explain field diagnostic procedures and necropsy techniques. • Explain proper labeling, preservation and transportation of	Whiteboard and markers Clinical examination charts Projector and multimedia materials Veterinary diagnostic manuals Reference textbooks	• Conduct clinical examination on cattle, sheep or goats, pigs and poultry and record findings appropriately. • Record temperature, pulse and respiration in farm animals. • Collect blood samples using appropriate venipuncture techniques and sample containers. • Demonstrate pregnancy diagnosis procedures in farm animals using approved techniques. • Conduct field necropsy on poultry and identify observable gross lesions. • Demonstrate proper	Guide students to: • Conduct clinical examination. • Collect blood samples. • Conduct pregnancy test. • Conduct field necropsy. • Complete sample-submission form. • Demonstrate cold-chain handling.	Live animals (cattle, sheep, pig, poultry). Stethoscope, thermometer, Stopwatch. Vacutainers (EDTA, plain), needles, syringes. Pregnancy palpation gloves. Necropsy kit, sample bags, formalin. Cold-chain box, ice packs, NVRI form, PPE.

		samples.		cold-chain handling and preservation of laboratory samples.		
GENERAL OBJECTIVE 3.0: Know the prevention and control of major bacterial diseases of cattle						
3-4	3.1 Explain anthrax. 3.2 Explain blackleg. 3.3 Explain bovine tuberculosis (Mycobacterium bovis). 3.4 Explain bovine brucellosis. 3.5 Explain contagious bovine pleuropneumonia. 3.6 Explain mastitis. 3.7 Explain bovine leptospirosis (Leptospira spp.). 3.8 Explain salmonellosis. 3.9 Explain pasteurellosis (Pasteurella multocida).	• Describe anthrax. • Describe blackleg. • Describe bovine TB. • Explain bovine brucellosis. • Describe CBPP. • Describe mastitis. • Describe leptospirosis. • Describe salmonellosis. • Describe pasteurellosis.	Charts of cattle bacterial diseases. Projector, whiteboard, sample vaccines (Anthrax-Sterne, blackleg, brucellosis). reference textbooks, internet, videos.	• Identify cattle disease specimens from preserved post-mortem. • Examine sample-stained smears under microscope. • Conduct intradermal tuberculin test on a cow (or simulate with placebo). • Read result at 72 hours. • Examine tuberculosis lesions on a slaughtered cattle carcass. • Demonstrate vaccination of a cow with anthrax (Sterne strain) and clostridial vaccines. • Develop a routine cattle vaccination schedule.	Guide students to: • Identify cattle disease specimens. • Examine stained smears. • Conduct tuberculin test. • Examine TB lesions. • Demonstrate vaccination. • Develop vaccination schedule.	Post-mortem specimens. Microscope, slides, stains. Tuberculin (PPD), syringe, calliper. Sample carcasses. Vaccines (Anthrax-Sterne, blackleg). Syringes, needles, vaccination schedule template, PPE.
GENERAL OBJECTIVE 4.0: Know the prevention and control of major bacterial and viral diseases of small ruminants.						

5	**4.1** Explain Peste des Petits Ruminants (PPR). **4.2** Explain contagious caprine pleuropneumonia (CCPP). **4.3** Explain sheep/goat pox (Capripoxvirus). **4.4** Explain sheep and goat pox. **4.5** Explain foot rot. **4.6** Explain caprine and ovine brucellosis. **4.7** Explain tetanus (Clostridium tetani). 4.8 Explain enterotoxaemia in small ruminants, including causative organisms, clinical signs, sudden mortality and preventive vaccination measures. 4.9 Explain caseous lymphadenitis (Corynebacterium pseudotuberculosis).	• Explain the causes, transmission and clinical signs of major small-ruminant diseases. • Discuss economic and public-health importance of zoonotic diseases affecting small ruminants. • Explain preventive and control measures including vaccination and biosecurity practices. • Discuss treatment and management procedures for affected animals. • Guide students during practical disease-identification exercises.	Charts of small-ruminant diseases. Projector, whiteboard, Sample vaccines (PPR, CCPP, clostridial). Reference textbooks, internet, videos.	• Identify small-ruminant disease specimens from post-mortem and clinical photos. • Examine PPR-affected animals at the institutional farm or photos; document clinical signs. • Conduct foot trimming and apply foot bath (formalin 5% or zinc sulphate 10%) on a goat. • Demonstrate vaccination of a goat with PPR and clostridial vaccines; record on register. • Examine sheep with Orf lesions; document. • Observe biosecurity (zoonotic). • Develop a small-ruminant vaccination calendar.	Guide students to: • Identify small-ruminant disease specimens. • Examine PPR-affected animals. • Conduct foot trimming and foot bath. • Demonstrate vaccination. • Examine Orf lesions. • Develop vaccination calendar.	Live small ruminants. Disease photos. Hoof shears, foot bath, formalin/zinc sulphate. Vaccines (PPR, CCPP, clostridial). Syringes, needles. Vaccination register, PPE.

GENERAL OBJECTIVE 5.0: Know the prevention and control of major bacterial and viral diseases of pigs						
6	5.1 Explain African Swine Fever. 5.2 Explain Classical Swine Fever (CSF is caused by Pestivirus). 5.3 Explain Foot and Mouth Disease of cloven-hoofed. 5.4 Explain swine erysipelas. 5.5 Explain salmonellosis in pigs. 5.6 Explain porcine respiratory disease complex (PRDC) multifactorial. 5.7 Explain Mycoplasma hyopneumoniae. 5.8 Explain Streptococcus suis ; meningitis, septicaemia; zoonosis. 5.9 Explain leptospirosis in pigs. 5.10 Explain atrophic rhinitis (Pasteurella	• Explain ASF. • Explain CSF. • Explain FMD. • Explain swine erysipelas. • Explain salmonellosis. • Explain PRDC. • Explain Mycoplasma hyopneumoniae. • Explain Streptococcus suis. • Explain leptospirosis in pigs. • Explain atrophic rhinitis. • Explain Glasser's disease. • Explain PED and TGE. • Discuss outbreak preparedness and reporting procedures for transboundary animal diseases. • Guide students during practical disease-identification and biosecurity exercises.	Charts of pig diseases. Projector, whiteboard, Sample vaccines. Reference textbooks, internet, videos.	• Examine pigs for clinical signs of common diseases. • Conduct biosecurity audit on a piggery — perimeter, footbath, PPE entry, all-in/all-out. • Demonstrate vaccination of a pig with appropriate vaccines. • Develop a piggery vaccination/biosecurity calendar. • Develop an ASF outbreak preparedness and response plan for a 1,000-pig farm as a group case study.	Guide students to: • Identify pig disease specimens. • Examine for clinical signs. • Conduct biosecurity audit. • Demonstrate vaccination. • Develop piggery calendar. • Develop ASF response plan.	Pig farm or specimens. Biosecurity audit checklist. Vaccines, syringes, needles. Vaccination register. ASF response template, PPE.

	multocida + Bordetella bronchiseptica) twisted snout, respiratory. 5.11 Explain Glasser's disease (Haemophilus parasuis). 5.12 Explain porcine epidemic diarrhoea (PED) and transmissible gastroenteritis (TGE) viral diarrhea.					
GENERAL OBJECTIVE 6.0: Know the prevention and control of major diseases of poultry.						
7-8	6.1 Explain Newcastle Disease (ND; causative agent. 6.2 Explain Highly Pathogenic Avian Influenza (HPAI causative agent. 6.3 Explain Infectious Bronchitis. 6.4 Explain Infectious Bursal Disease. 6.5 Explain Marek's	• Explain Newcastle disease. • Explain HPAI. • Explain IB. • Explain IBD/Gumboro. • Explain Marek's disease. • Explain fowl pox. • Explain chicken anemia virus. • Explain fowl cholera. • Explain fowl typhoid and Pullorum. • Explain coccidiosis.	Charts of poultry diseases. Projector, whiteboard, sample vaccines. Reference textbooks, internet, videos.	• Conduct field necropsy on a deceased chicken. • Identify lesions of common diseases. • Demonstrate vaccination of poultry — eye drop (ND), wing-web (fowl pox), drinking water (IBD), intramuscular (HPAI). • Conduct McMaster oocyst count for	Guide students to: • Conduct field necropsy on chicken. • Demonstrate poultry vaccination. • Conduct McMaster for coccidia. • Develop vaccination schedule. • Conduct biosecurity audit.	Deceased chickens, necropsy kit. Vaccines (ND, fowl pox, IBD, HPAI). Eye droppers, syringes, needles. McMaster slides, flotation, microscope. Vaccination schedule

	Disease. 6.6 Explain fowl pox (Avipoxvirus) cutaneous and diphtheritic forms. 6.7 Explain chicken anemia virus. 6.8 Explain fowl cholera. 6.9 Explain fowl typhoid. 6.10 Explain coccidiosis (Eimeria). 6.11 Explain mycoplasmosis. 6.12 Explain egg drop syndrome (EDS-76). 6.13 Explain avian encephalomyelitis. 6.14 Explain aspergillosis (Aspergillus fumigatus). 6.15 Explain egg-laying issues.	• Explain mycoplasmosis. • Explain EDS. • Explain avian encephalomyelitis. • Explain aspergillosis. • Explain egg-laying issues.		coccidiosis investigation. • Develop a comprehensive poultry vaccination schedule for broiler (35 days) and layer (52 weeks). • Conduct biosecurity audit on a poultry house.		template. Biosecurity audit checklist. PPE.
GENERAL OBJECTIVE 7.0: Understand the management of nutritional, metabolic and toxic diseases in farm animals.						
9	7.1 Explain milk fever treatment.	• Explain milk fever.	Charts of nutritional/m	• Examine moldy feed samples.	Guide students to: • Examine moldy feed.	Feed samples (good and

	7.2 Explain ketosis (acetonemia), clinical signs (anorexia, weight loss, sweet breath, neurological). 7.3 Explain grass tetany. 7.4 Explain urolithiasis (urinary calculi). 7.5 Explain bloat (ruminal tympany), frothy bloat (legumes). 7.6 Explain pregnancy toxemia (twin-lamb disease). 7.7 Explain acidosis. 7.8 Explain plant toxicities. 7.9 Explain mycotoxicosis, aflatoxin. 7.10 Explain urea poisoning. 7.11 Explain rodenticide and pesticide poisoning. 7.12 Explain heat stroke and cold	• Explain ketosis. • Explain grass tetany. • Explain urolithiasis. • Explain bloat. • Explain pregnancy toxemia. • Explain acidosis. • Explain plant toxicities. • Explain mycotoxicosis. • Explain urea poisoning. • Explain pesticide poisoning. • Explain heat and cold stress.	etabolic diseases. Projector, whiteboard, reference textbooks, internet.	• Identify Aspergillus flavus colonies. • Identify common toxic plants on the institutional farm or from samples. • Conduct field test for urea poisoning — collect urine and rumen samples. • Develop a feed-storage protocol to prevent mycotoxin contamination.	• Identify toxic plants. • Conduct urea-poisoning test. • Develop feed-storage protocol.	moldy). Microscope, slides, stains. Toxic plant samples. pH meter, ammonia test strips, PPE.

	stress.					
GENERAL OBJECTIVE 8.0: Understand integrated herd and flock health management practices.						
10-11	8.1 Explain herd-health management. 8.2 Explain biosecurity at three levels. 8.3 Explain vaccination programmes in cattle. 8.4 Explain principles of drug use. 8.5 Explain antimicrobial resistance (AMR). 8.6 Explain parasiticide stewardship (links to APT 411). 8.7 Explain internal/external parasite-control programmes. 8.8 Explain hygiene management. 8.9 Explain nutritional management as	• Explain herd-health management. • Explain biosecurity at three levels. • Explain vaccination programmes for each species. • Explain drug-use principles. • Explain AMR and stewardship. • Explain parasiticide stewardship. • Explain parasite-control programmes. • Explain hygiene management. • Explain nutritional disease prevention. • Explain stress management. • Explain KPIs.	Charts of herd-health frameworks. Projector, whiteboard Sample biosecurity protocols, AMR posters, reference textbooks (Curtis — Herd Health), internet.	• Conduct a comprehensive biosecurity audit on the institutional farm using a structured tool; identify gaps; recommend improvements. • Develop comprehensive vaccination calendars for cattle, small ruminants, pigs and poultry at the institutional farm. • Develop a herd-health protocol for a 100-cow dairy unit covering biosecurity, vaccination, parasites, mastitis prevention, calf care, breeding and KPI monitoring. • Set up a herd-health record-keeping system in Excel/Google Sheets. • Compute mortality rate, calving interval and FCR for the	Guide students to: • Conduct biosecurity audit. • Develop vaccination calendars. • Develop herd-health protocol. • Conduct AMR audit. • Develop AMR Stewardship plan. • Set up record-keeping system. • Compute KPIs. • Develop HACCP-style plan.	Biosecurity audit tool. Vaccination-calendar templates. Herd-health protocol template. AMR audit form, AMR Stewardship template. Computer with Excel/Google Sheets. Calculator, KPI worksheet. HACCP-style plan template. Projector, presentation board.

	disease prevention. 8.10 Explain stress management including handling, transport, mixing, weaning, environmental. 8.11 Explain key performance indicators (KPIs) for herd health.			institutional farm. • Group case study: develop a HACCP-style herd-health plan for a 1,000-pig farm or a 10,000-bird poultry house.		
GENERAL OBJECTIVE 9.0: Appreciate disease surveillance, outbreak reporting, One Health and animal health entrepreneurship.						
13-15	9.1 Explain principles of disease surveillance and reporting. 9.2 Explain zoonotic diseases and their public-health importance. 9.3 Explain outbreak investigation and disease-control procedures. 9.4 Explain the	• Explain principles of disease surveillance and reporting. • Discuss zoonotic diseases and their public-health importance. • Explain outbreak investigation and disease-control procedures. • Discuss the role of veterinary institutions in livestock-health management. • Explain livestock biosecurity and	Charts of surveillance frameworks. WOAH-listed diseases reference, projector, whiteboard. NVRI/FMARD report templates. Reference textbooks, internet, mobile devices.	• Develop a disease-surveillance plan for the institutional farm. • Develop a One-Health awareness flyer for community use. • Develop an animal-health entrepreneurship business plan (e.g. mobile vaccination service for smallholder farmers). • Present herd-health plan and disease-control strategies for	Guide students to: • Develop One-Health flyer. • Develop entrepreneurship plan. • Compute economic loss. • Conduct debate. • Present strategies.	Awarenes s-material Calculator Projector and presentati on materials Mobile devices and internet facilities PPE

	role of veterinary institutions in livestock-health management. 9.5 Explain livestock biosecurity and disease-prevention practices. 9.6 Discuss entrepreneurial opportunities in livestock-health services.	disease-prevention practices. • Discuss entrepreneurial opportunities in livestock-health services.		the institutional farm.		

Course Assessment:

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

ANIMAL PRODUCTS PROCESSING AND HYGIENE

PROGRAMME: HIGHERR NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: ANIMAL PRODUCTS PROCESSING AND HYGIENE	**COURSE CODE: APT 423**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL 3 HOURS/WEEK**
GOAL: The course is designed to equip the students with the knowledge and skills necessary for handling and processing animal products for human consumption.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know principles and operations of the abattoir; 2.0 Know how to handle small and large animals in a lairage; 3.0 Know how to handle poultry species in preparation for processing; 4.0 Know to how to assess carcass quality for different types of meat; 5.0 Know how produce prime cuts from beef, chevon, mutton, bacon and chicken; 6.0 Understand Management of commercial livestock logistics and cold-chain transport operations; 7.0 Know how to collect, store and process quality milk; 8.0 Know how to sanitize an abattoir and poultry processing plant.		

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY						
COURSE TITLE: ANIMAL PRODUCTS PROCESSING AND HYGIENE		**COURSE CODE: APT 423**		**CONTACT HOURS: 4 HOURS/WEEK**		
		CREDIT UNIT: 4		**THEORETICAL: 1 HOUR/WEEK**		
YEAR: II SEMESTER: II		**PRE-REQUISITE:**		**PRACTICAL 3 HOURS/WEEK**		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills necessary for the handling and processing of animals for human consumption						
GENERAL OBJECTIVE 1.0: Know the principles and operations of abattoir and poultry processing plant in both conventional and halal systems						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Define an abattoir. 1.2 Define poultry processing plant. 1.3 Explain the management of abattoir and processing plant. 1.4 Define halal method of animal slaughter.	• Explain the principles of abattoir operations • Explain general maintenance of slaughterhouses • Explain the Islamic halal method of animal processing	Textbooks, computer system, municipal abattoir	• Identify an abattoir. • Identify poultry processing plant. • Identify halal compliant abattoir in the environment. • Inspect abattoir records.	Guide the students to: • Identify an abattoir • Identify poultry processing plant • Identify halal compliant abattoir in the environment • Inspect abattoir records	Municipal abattoir, Hala abattoir, School bus PPE
General Objective 2.0: Know how to handle small and large animals in a lairage						
2-3	2.1 Define a lairage. 2.2 Describe handling methods for small animals (sheep, goat, pigs etc). 2.3 Describe handling methods for large animals (cattle,	• Explain the common features of a standard lairage and its use • Explain handling methods for each animal species • Highlight the	Textbooks, computer system, internet, municipal abattoir	• Identify a lairage. • Carry out routine hygiene and maintenance of a lairage.	Guide the students to: • Identify a lairage • Carry out routine hygiene and maintenance of a lairage	Municipal abattoir, School bus PPE

	camel, donkey etc). 2.4 Describe the similarities and differences in the operations.	similarities and differences in their handling operations				
General Objective 3.0: Know how to handle poultry species in preparation for processing						
4-5	3.1 Define a poultry processing plant. 3.2 Describe handling methos for different categories of birds. 3.3 Explain routine operations and precautionary measures in a poultry processing plant.	• Explain the common features of a poultry processing plant • Explain methods of processing of the birds • Explain the sanitation measures often adopted	Textbooks, computer system, internet, municipal abattoir	• Use poultry handling equipment and protective clothing. • Demonstrate weighing and sorting poultry before processing. • Practice fasting and crate loading procedures for transportation. • Demonstrate humane handling and welfare practices. • Identify stressed, injured or diseased birds before processing. • Practice cleaning and sanitation of processing equipment and work areas. • Demonstrate	Guide students to: • Use of poultry handling equipment and protective clothing. • Demonstrate weighing and sorting poultry before processing. • Practice fasting and crate loading procedures for transportation. • Demonstrate humane handling and welfare practices. • Identify stressed, injured or diseased birds before processing. • Practice cleaning and sanitation of processing equipment and work areas. • Demonstrate biosecurity measures	Municipal abattoir, Hala abattoir, School bus PPE

				biosecurity measures during poultry handling. • Demonstrate pre-slaughter preparation and stunning procedures. • Record keeping of poultry handling and processing activities.	during poultry handling. • Demonstrate pre-slaughter preparation and stunning procedures. • Record keeping of poultry handling and processing activities.	
General Objective 4.0: Know to how to assess carcass quality of different types of meat						
6-7	4.1 Define carcass quality assessment. 4.2 Explain key carcass assessment factors. 4.3 Explain indicators of quality meat. 4.4 Explain indicators of meat spoilage.	• Describe the factors that determine quality meat • Describe signs of quality meat • Describe signs of meat spoilage	Textbooks, computer system, internet, municipal abattoir	• Identify different meat carcasses (beef, goat, sheep, pork and poultry). • Demonstrate carcass inspection procedures in an abattoir or meat processing unit. • Practice assessment of carcass color, texture, fat distribution and marbling. • Determine dressing percentage from slaughtered animals. • Practice grading	Guide students to: • Identify different meat carcasses (beef, goat, sheep, pork and poultry). • Demonstrate carcass inspection procedures in an abattoir or meat processing unit. • Practice assessment of carcass color, texture, fat distribution and marbling. • Determinae dressing percentage from slaughtered animals. • Practice grading and classification of meat	Municipal abattoir, Hala abattoir, School bus PPE

				and classification of meat carcasses. • Identify diseased, bruised or contaminated carcasses and organs. • Evaluate meat freshness using sensory methods (odour, appearance and firmness). • Demonstrate hygienic handling and safety procedures during carcass assessment.	carcasses. • Identify diseased, bruised or contaminated carcasses and organs. • Evaluate meat freshness using sensory methods (odour, appearance and firmness). • Demonstrate hygienic handling and safety procedures during carcass assessment	
General Objective 5.0: Know how produce prime cuts from beef, chevon, mutton, bacon and chicken						
8-9	5.1 Explain the prime cuts of beef. 5.2 Explain the prime cuts of chevon/ mutton. 5.3 Explain the prime cuts of bacon. 5.4 Explain the prime cuts of chicken.	• Describe the major cuts of a beef animal • Describe the major cuts of a chevon /mutton • Describe the major cuts of bacon • Describe the major cuts of chicken	Textbooks, computer system, internet, municipal/ private, abattoir, meat laboratory and meat chart	• Inspect the whole cold carcass before splitting. • Inspect prime cuts of various classes of meat. • Inspect subprimal cuts of the above-mentioned classes of meat. • Participate in splitting of chicken and cutting them into prime and subprimal parts the by products.	Guide the student to: • Inspect the whole cold carcass before splitting • Inspect prime cuts of various classes of meat • Inspect subprimal cuts of the above-mentioned classes of meat • Participate in splitting of chicken and cutting them into prime and subprimal parts	Municipal/ private abattoir, School meat laboratory PPE

General Objective 6.0: Understand Management of commercial livestock logistics and cold-chain transport operations						
10-11	6.1 Describe temperature data-logging. 6.2 Explain HACCP for cold-chain logistics. 6.3 Outline digital freight-tracking platforms. 6.4 Describe vaccine cold-chain (2–8 °C) special requirements for livestock-vaccine distribution. 6.5 Discuss carbon-footprint of refrigerated transport.	• Outline logistics as sub-value chain. • Describe WOAH/FAO transport standards. • Explain ATP vehicle classes. • Discuss Nigerian logistics corridors. • Outline last-mile cold-chain • Describe data-logging technology. • Explain HACCP for cold-chain. • Outline digital freight-tracking. • Describe vaccine cold-chain. • Discuss carbon-footprint.	WOAH Code Chapter 7.3, ATP regulations document, Nigerian livestock corridor maps, Last-mile packaging photos, Data-logger samples, HACCP for logistics templates, Kobo360/Trella platform demos, WHO vaccine cold-chain guidelines.	• Conduct compliance audit on a livestock-transport vehicle. • Calculate stocking densities for cattle, sheep, pig and broiler transport. • Develop a commercial-grade journey plan with rest-stops and welfare provisions. • Operate temperature data-loggers and download data via USB or wireless. • Construct an HACCP plan for milk or vaccine cold-chain distribution. • Demonstrate Kobo360/Trella freight-tracking platform. • Calculate carbon-footprint of a	Guide students to: • Conduct compliance audit. • Calculate stocking-density. • Carryout journey-plan development • Conduct data-logger operation and data download. • Construct HACCP plan. • Demonstrate platform. • Calculate carbon-footprint	Access to transport vehicle (visit), Inspection checklist, Calculator, planning worksheets, Data-loggers (TempTale, LogTag), HACCP templates, Smartphones with Kobo360/Trella apps, Carbon-footprint calculation worksheets.

				refrigerated journey.		
General Objective 7.0: Know how to collect, store and process quality milk						
12-13	7.1 Define milk. 7.2 Explain the process of milk collection. 7.3 Explain the methods of milk storage. 7.4 Describe the process of milk preservation.	• Explain what milk is and its constituents • Describe the process of milk collection • Describe the methods of milk storage • Describe the process of milk pasteurization	Textbooks, computer system, internet, milking machine, pasteurizer, deep freezer	• Examine milk and its constituents. • Engage in farm milk collection practice. • Identify milk holding vats. • Identify pasteurizing equipment.	Guide the student to: • Examine milk and its constituents • Engage in farm milk collection practice • Identify milk holding vats • Identify pasteurizing equipment	Dairy farm, Pasteurizer, Milking machines, Milk holding vats, Deep freezer, Milk analysis laboratory
General Objective 8.0: Know how to sanitize an abattoir and poultry processing plant						
14-15	8.1 List common abattoir sanitizers. 8.2 Explain their uses. 8.3 Explain the consequences of their misuse.	• Describe the constituents of major sanitizers in use • Describe the mixing and application rates of these sanitizers • Explain the implications of wrong use of the sanitizers	Samples and labels of Quaternary Ammonium Compounds, Chlorine based compounds Alcohols Acidic agents	• Identify sanitation tools and equipment (brushes, sprayers, PPE, detergents). • Prepare safe dilution of disinfectants (e.g., chlorine, quaternary ammonium compounds, iodine-based solutions). • Sanitize slaughter slabs, bleeding	Guide the student to • Identify sanitation tools and equipment (brushes, sprayers, PPE, detergents). • Prepare safe dilution of disinfectants (e.g., chlorine, quaternary ammonium compounds, iodine-based solutions). • Sanitize slaughter slabs, bleeding areas, dressing halls	Quaternary Ammonium Compounds, Chlorine based compounds Alcohols Acidic agents PPE

				areas, dressing halls and processing tables. • Sterilize knives, hooks, saws and other equipment. • Collect waste, segregation and safe disposal methods (incineration, burial, rendering, effluent treatment). • Demonstrate biosecurity drill: footbath preparation, use PPE, restricted zone control and personnel hygiene. • Carry out environmental sanitation:	and processing tables. • Sterilize knives, hooks, saws and other equipment. • Collect waste, segregation and safe disposal methods (incineration, burial, rendering, effluent treatment). • Biosecurity drill: footbath preparation, PPE use, restricted zone control and personnel hygiene. • Carry out environmental sanitation:	

Course Assessment:

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

DAIRY CATTLE PRODUCTION

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: DAIRY CATTLE PRODUCTION	**COURSE CODE: APT 424**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
GOAL: The course is designed to provide students with knowledge of all major aspects of Dairy Cattle Production and the principles of milk production.		

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

1.0 Know the history and development of dairy cattle and dairy cattle industry in Nigeria;
2.0 Know the different breeds of dairy cattle and their characteristics;
3.0 Know the equipment and the design of dairy cattle structures;
4.0 Know the breeding and reproductive characteristics of dairy cattle;
5.0 Know the nutritional requirements of dairy cattle at different physiological stages;
6.0 Know the pregnancy status in dairy cattle and the factors affecting it;
7.0 Know how to raise and manage calves;
8.0 Understand the principles of milk secretion, milking techniques and milk composition;
9.0 Know advanced reproductive technologies in commercial dairy operations;
10.0 Know management problems of post-parturient cows;
11.0 Know how to maintain the health of the dairy herd.

DAIRY CATTLE PRODUCTION

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: DAIRY CATTLE PRODUCTION	**COURSE CODE: APT 424**	**CONTACT HOURS: 4 HOURS/WEEK**
	CREDIT UNIT: 4	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 3 HOURS/WEEK**
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL		
GOAL: The course is designed to provide students with knowledge of all major aspects of Dairy Cattle Production and the principles of milk production.		
GENERAL OBJECTIVE 1.0: Know the history and development of dairy cattle and dairy cattle industry in Nigeria.		

THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Explain the origin and development of the dairy cattle industry in Nigeria. 1.2 Explain the distribution and economic importance of dairy cattle in the world. 1.2 1.3 Explain opportunities in the dairy industry in Nigeria.	• Explain the origin and development of the dairy cattle industry in Nigeria. • Explain the distribution and economic importance of dairy cattle in the world. • Explain opportunities in the dairy industry in Nigeria.	Charts Maps of Nigeria	• Identify major dairy-producing states using map exercise.	Guide students to: • Identify major dairy-producing states using map exercise.	Maps Handouts
General Objective 2.0: Know the different breeds of dairy cattle and their characteristics.						
2	2.1 Describe the breed characteristics of dairy cattle. 2.2 Identify the indigenous (e.g. Bunaji/White Fulani) and exotic (e.g. Friesian, Jersey, Guernsey) dairy cattle	• Describe the breed characteristics of dairy cattle. • Identify the indigenous (e.g. Bunaji/White Fulani) and exotic (e.g. Friesian, Jersey, Guernsey) dairy cattle	Photographs Slides Slide Projector	• Visit institutional dairy unit. • Identify breed characteristics of available cattle.	Guide the students to: • Visit institutional dairy unit • Identify breed characteristics of available cattle.	Live cattle Observation sheets Breed charts

	breeds in Nigeria. 2.2 Identify the distinctive characteristics (milk yield, heat tolerance, disease resistance) between indigenous and exotic breeds.	breeds in Nigeria. • Identify the distinctive characteristics (milk yield, heat tolerance, disease resistance) between indigenous and exotic breeds.				
General Objective 3.0: Know the equipment and the design of dairy cattle structures.						
3	3.1 Explain the factors to consider in planning and designing a dairy building (ventilation, drainage, space, orientation). 3.2 Describe the various types of dairy buildings: (i) Stanchion stall/barn (ii) Loose housing (iii) Free stalls and cattle shed. 3.3 List the functions of the various parts of dairy buildings and state their advantages and disadvantages. 3.4 Describe machine-milking parlor layout, automated calf-feeder systems, and milking-robot concepts.	• Explain the factors to consider in planning and designing a dairy building (ventilation, drainage, space, orientation). • Describe the various types of dairy buildings: (i) Stanchion stall/barn (ii) Loose housing (iii) Free stalls and cattle shed. • List the functions of the various parts of dairy buildings and state their advantages and disadvantages. • Describe machine-milking parlour layout, automated calf-feeder systems, and milking-robot concepts.	Milking Parlor Calf sheds Holding pen Grade log books Parlor design drawings	• Draw a labelled plan of a dairy building showing stalls, milking area, calf pen, feed store, manure channel, and milking parlor. • Identify components of a milking machine and automated calf feeder.	• Draw a labelled plan of a dairy building showing stalls, milking area, calf pen, feed store, manure channel, and milking parlor. • Identify components of a milking machine and automated calf feeder.	Drawing paper Rulers Milking machine diagrams Automated calf feeder pictures
General Objective 4.0: Know the breeding and reproductive characteristics of dairy cattle.						

4-5	4.1 Explain the essential steps in developing a profitable breeding programme. 4.2 Describe different systems of breeding in dairy cattle (purebred, grading-up, crossbreeding). 4.3 Explain breeding efficiency in dairy cattle production. 4.4 Describe the reproductive organs of the dairy bull and cow. 4.5 Describe the process of reproductive development: (i) sexual maturity (ii) oestrus cycle/oestrus (iii) oestrus asteurization. 4.6 Explain mating systems: (i) Free/natural mating (ii) Controlled mating (iii) Artificial Insemination. 4.7 Explain the practical and economic implications of artificial insemination 4.8 Explain super-ovulation, ova transfer, and bull percentage. Describe species-	• Discuss the essential steps in developing a profitable breeding programme. • Explain different systems of breeding in dairy cattle (purebred, grading-up, crossbreeding). • Discuss breeding efficiency in dairy cattle production. • Explain the reproductive organs of the dairy bull and cow. • Discuss the process of reproductive development: ➢ sexual maturity ➢ oestrus cycle/oestrus ➢ oestrus asteurization • Explain mating systems: ➢ Free/natural mating ➢ Controlled mating ➢ Artificial Insemination. • Discuss the practical and economic implications of artificial insemination. • Explain super-	Charts of reproductive organs Assignment sheets AI kits Ultrasound scanner	• Identify a cow on heat (observe signs: restlessness, mounting, mucous discharge). • Conduct Artificial Insemination under supervision (thawing semen, loading gun, per-vaginal insemination). • Perform oestrus asteurization using CIDR/hormones (role-play or model).	Guide students to: • Identify a cow on heat (observe signs: restlessness, mounting, mucous discharge). • Conduct Artificial Insemination under supervision (thawing semen, loading gun, per-vaginal insemination). • Perform oestrus asteurization using CIDR/hormones (role-play or model).	Live cows AI kits (straws, gloves, gun, nitrogen flask) Oestrus detection chart CIDR/hormone ampoules Ultrasound scanner

	specific AI protocols for cattle including rectal palpation and ultrasound pregnancy diagnosis.	ovulation, ova transfer, and bull percentage. • Describe species-specific AI protocols for cattle including rectal palpation and ultrasound pregnancy diagnosis.				
General Objective 5.0: Know the nutritional requirements of dairy cattle at different physiological stages.						
6	5.1 Explain the feed requirements at different levels of pregnancy. 5.2 Explain steaming-up in dairy cows (challenge feeding) and its benefits. 5.3 Explain climate-smart feeding strategies.	• Explain the feed requirements at different levels of pregnancy (dry period, transition period, early lactation, peak lactation, mid and late lactation). • Explain steaming-up in dairy cows (challenge feeding) and its benefits. • Discuss climate-smart feeding strategies (low-emission diets, heat-stress feeding adjustments, water-use efficiency).	Bailer Mower Rake Sickles Silage materials Feed ingredients Mixers	• Carry out Formulation and mixing of a balanced dairy cattle ration for a lactating cow. • Establish a small demonstration pasture plot. • Make hay and silage for dairy cattle. • Calculate least-cost ration using Pearson's Square and, where available, computer-aided formulation (Allix/Excel).	• Formulate and mix a balanced dairy cattle ration for a lactating cow. • Establish a small demonstration pasture plot; make hay and silage for dairy cattle. • Calculate least-cost ration using Pearson's Square and, where available, computer-aided formulation (Allix/Excel).	Feed ingredients Mixing equipment Bailer Mower Rake Silage bags/pits Laptops/Excel templates (where available)
General Objective 6.0: Know the pregnancy status in dairy cattle and the factors affecting it.						
7	6.1 Explain pregnancy and gestation in dairy cattle. 6.2 Describe: i. Preparation of calving pens ii. Care of cow/heifer	• Explain pregnancy and gestation in dairy cattle: ➢ Pregnancy and methods of detection (rectal palpation,	Charts Live pregnant cattle Calving pen Ultrasound scanner	• Identify pregnant cattle by external signs and, where possible, rectal palpation/ultrasound. • Prepare a calving pen (bedding, disinfection,	Guide the students to: • Identify pregnant cattle by external signs and, where possible, rectal	Live cattle Calving pen Bedding materials Calving

	before calving iii. Signs of parturition and care of the dam during calving iv. Abnormal presentation of calf during parturition/freemartins v. Care of dam after calving. 6.3 Explain physiological and nutritional disturbances associated with reproduction.	ultrasound, progesterone assay) ➢ Factors affecting gestation ➢ Age at first calving ➢ Calving rate and interval ➢ Breeding cow efficiency. • Describe: ➢ Preparation of calving pens ➢ Care of cow/heifer before calving ➢ Signs of parturition and care of the dam during calving ➢ Abnormal presentation of calf during parturition/freemartinism ➢ Care of dam after calving. • Explain physiological and nutritional disturbances associated with reproduction (milk fever, ketosis, displaced abomasum) and how to handle them.		equipment checklist). • Role-play assisting a calving (using model).	palpation/ultrasound. • Prepare a calving pen (bedding, disinfection, equipment checklist). • Role-play assisting a calving (using model).	ropes Gloves Model/manikin
General Objective 7.0: Know how to raise and manage calves.						

8	7.1 Explain the importance of caring for the calf immediately after calving. 7.2 Describe colostrum and its importance to calf immunity and growth. 7.3 Explain the feeding systems for dairy calves. 7.4 Explain the different systems of calf rearing. 7.5 Describe sanitation practices in the calf pen. 7.6 Explain calf weaning. 7.7 Describe automated calf feeder systems and computer-monitored milk allowances.	• Explain the importance of caring for the calf immediately after calving (clearing airways, drying, navel disinfection). • Describe colostrum and its importance to calf immunity and growth. • Explain the feeding systems for dairy calves (bucket feeding, nipple feeding, nurse-cow, automated feeder). • Explain the different systems of calf rearing (individual pens vs. group pens). • Describe sanitation practices in the calf pen. • Explain calf weaning (criteria, timing, methods). • Describe automated calf feeder systems and computer-monitored milk allowances.	Calf pen Colostrum Navel disinfectant Drenching equipment Calf feeders	• Clean the calf and revive if it fails to breathe (simulate). • Cut the navel cord of a newborn calf. • Get the calf to stand and feed colostrum within the first 2 hours. • Prepare calf milk replacer at correct concentration; practice bucket-feeding technique. • Inspect a calf pen. • Complete a sanitation log sheet.	Guide students to: • Clean the calf and revive if it fails to breathe (simulate). • Cut the navel cord of a newborn calf. • Get the calf to stand and feed colostrum within the first 2 hours. • Prepare calf milk replacer at correct concentration; practice bucket-feeding technique. • Inspect a calf pen; complete a sanitation log sheet.	Live calves Colostrum/ milk replacer Buckets/nipple feeders Navel dip (iodine) Cleaning materials Sanitation log sheets
General Objective 8.0: Understand the principles of milk secretion, milking techniques and milk composition.						
9-11	8.1 Describe the anatomy and physiology of the udder and teats. 8.2 Describe milk synthesis	• Describe the anatomy and physiology of the udder and teats. • Describe milk synthesis	Udder anatomy charts Milking	• Carry out: - Babcock test for fat % - SNF test	Guide students to: • Carry out: - Babcock test for fat %	Milking machine Milking utensils

	and secretion. 8.3 Explain milk let-down, milk hold-up and the factors involved. 8.4 Define milk. 8.5 Explain milk composition 8.6 Describe factors affecting milk composition. 8.7 Explain milk properties. 8.8 Explain the uses and nutritional value of milk. 8.9 Explain milk flavours and odours, their causes and preventive measures. 8.10 Explain laboratory tests for milk quality and composition. 8.11 Describe different milking methods. 8.12 Explain care of the cow before and during milking. 8.13 Describe the operational principles of a milking machine. 8.14 Explain lactation curve, factors affecting it, and methods of drying off cows. 8.15 Describe milk processing techniques.	and secretion (alveoli, cisterns, ducts). • Explain milk let-down, milk hold-up and the factors involved (oxytocin). • Explain milk • Explain milk composition (water, fat, protein, lactose, minerals, vitamins). • Describe factors affecting milk composition • Explain milk properties. • Explain the uses and nutritional value of milk. • Explain milk flavours and odours, their causes and preventive measures. • Explain laboratory tests for milk quality and composition (Babcock, SNF, California Mastitis Test). • Describe different milking methods (hand stripping, machine milking). • Explain care of the cow before and during	utensils Milking machine Laboratory reagents SCC meter (or chart) Refrigerator/chiller	- CMT for mastitis detection. • Practice hand milking technique on a live cow. • Compare output and time with machine milking. • Demonstrate pre-milking teat preparation (washing, drying, pre-dipping) and post-milking teat dipping. • Identify components of a milking machine (cluster, pulsator, milk receiver, vacuum pump). • Observe cream separation and simple pasteurization (HTST or LTH method). • Record SCC result and interpret. • Observe parlour-hygiene standard.	- SNF test - CMT for mastitis detection. • Practice hand milking technique on a live cow; then compare output and time with machine milking. • Demonstrate pre-milking teat preparation (washing, drying, pre-dipping) and post-milking teat dipping. • Identify components of a milking machine (cluster, pulsator, milk receiver, vacuum pump). • Observe cream separation and simple pasteurization (HTST or LTH method). Record SCC result and interpret; discuss parlour-hygiene standard.	Babcock tubes and centrifuge CMT paddle SCC strips/meter Pasteuriser (or water bath) Cream separator Teat dip cups Record sheets

	8.16 Describe milk products and their uses. 8.17 Explain somatic-cell count (SCC) monitoring, automated milking robots and parlour-hygiene protocols (pre- and post-dipping).	milking; enumerate factors in milk handling. • Describe the operational principles of a milking machine; outline advantages and disadvantages of machine vs hand milking. • Explain lactation curve, factors affecting it, and methods of drying off cows. • Describe milk processing techniques. • Describe milk products and their uses. • Explain somatic-cell count (SCC) monitoring, automated milking robots and parlour-hygiene protocols (pre- and post-dipping).				
General Objective 9.0: Know advanced reproductive technologies in commercial dairy operations						
11	9.1 Describe rectovaginal AI technique in dairy cattle with timing optimisation (AM/PM rule). 9.2 Outline detailed oestrus-synchronisation	• Describe rectovaginal AI technique. • Outline detailed synchronisation protocols with timelines. • Describe heat-detection technologies.	AI training mannequin or palpation arm, Synchronisation protocol flowcharts,	• Perform rectovaginal AI on dairy heifers using training mannequin and live heifers. • Compose a complete Ov-Synch protocol	Guide students to: • Perform rectovaginal AI on mannequin and heifers. • Compose Ov-Synch protocol	AI mannequin /palpation arm, Live dairy heifers, CIDR,

	protocols. 9.3 Describe heat-detection technologies. 9.4 Explain Estrotect/Beacon heat-detection patches. 9.5 Describe pregnancy diagnosis. 9.6 Outline sexed-semen technology. 9.7 Describe embryo transfer (ET) workflow. 9.8 Outline in vitro fertilisation (IVF) and Ovum Pick-Up (OPU) technologies. 9.9 Explain CRISPR/Cas9 awareness: hornless dairy cattle (TALEN-edited), heat-tolerance gene editing.	• Explain heat-detection patches. • Describe pregnancy-diagnosis methods. • Outline sexed-semen technology. • Describe ET workflow. • Outline IVF and OPU. • Discuss CRISPR awareness.	Activity-monitor collar samples, KaMaR/Estrotect samples Ultrasound machine (portable trans-rectal), PAG ELISA kit information, Sexed-semen straws (sample), ET workflow video, CRISPR case-study materials	calendar including hormone schedule. • Apply tail-paint and KaMaR mounts on a group of cows. • Operate activity-monitor collar dashboard (where available). • Perform rectal palpation pregnancy diagnosis on pregnant and non-pregnant cows. • Operate trans-rectal ultrasound for pregnancy diagnosis. • Interpret PAG ELISA result data. • View ET and IVF workflow videos and complete a comprehension exercise.	calendar. • Apply tail-paint and KaMaR application. • Conduct activity-monitor dashboard operation. • Perform rectal palpation. • Carryout ultrasound operation. • Conduct PAG ELISA interpretation. • Carryout ET/IVF video review.	$PGF_2\alpha$, GnRH (sample sets), Tail-paint, KaMaR mounts, Activity-monitor collar dashboard demo, Pregnant and non-pregnant cows, Portable trans-rectal ultrasound, PAG ELISA result sheets, ET/IVF demonstration videos
General Objective 10.0: Know management problems of post-parturient cows.						
12	10.1 Explain the management of the post-parturient cow	• Explain the management of the post-parturient cow	Body condition scoring chart	• Score body condition of at least 2 cows using a standardised	Guide students to: • Score body condition of at	Live cows BCS reference

	10.2 Describe milk fever (hypocalcaemia) 10.3 Explain udder oedema: causes and control. 10.4 Describe mastitis. 10.5 Explain the importance of record keeping on a dairy farm 10.6Explain use of SCC records to identify sub-clinical mastitis cows	(transition period, negative energy balance, body condition scoring). • Describe milk fever (hypocalcaemia) • Explain udder oedema: causes and control. • Describe mastitis: causes, types (clinical vs. sub-clinical), symptoms, effects, prevention (teat dipping, dry-cow therapy) and control. • Explain the importance of record keeping on a dairy farm (production records, health records, breeding records, financial records). Demonstrate use of SCC records to identify sub-clinical mastitis cows; introduce digital dairy-record apps.	Dairy records (sample) Pictures of mastitis CMT paddle Dry-cow therapy tubes Digital record app (phone)	BCS chart (1–5 scale). • Perform CMT on milk from individual quarters; record and interpret results. Complete a sample dairy-farm record card (daily milk yield, health events, AI dates, dry-off date). • Enter production data into a digital dairy app or Excel sheet. • Generate a simple lactation curve chart.	least 2 cows using a standardised BCS chart (1–5 scale). • Perform CMT on milk from individual quarters; record and interpret results. Complete a sample dairy-farm record card (daily milk yield, health events, AI dates, dry-off date). Enter production data into a digital dairy app or Excel sheet; generate a simple lactation curve chart.	chart CMT paddle Sample record cards Laptop/tablet with dairy app or Excel
General Objective 11.0: Know how to maintain the health of the dairy herd.						
13-15	11.1 Explain the steps and processes in maintaining a healthy dairy herd. 11.2 Explain the main ailments, parasites and diseases of dairy cattle. 11.3 Describe the	• Explain the steps and processes in maintaining a healthy dairy herd (biosecurity, vaccination calendar, pest control, sanitation). • Explain the main	Branding iron Drenching gun Dip tank/spray race Hoof trimmers Parasite	• Carry out: - Branding - Deworming with drenching gun - Dehorning - Dipping/spraying for ectoparasites	Guide students to: • Carry out: - Branding - Deworming with drenching gun	Live cattle Branding iron Drenching gun Dip tank/spray race Hoof

	reproductive diseases of dairy cattle. 11.4 Apply WOAH five-domains animal welfare model to dairy herd management.	ailments, parasites and diseases of dairy cattle: causes, effects, prevention and control • Describe the reproductive diseases of dairy cattle (Brucellosis, Trichomoniasis, Vibriosis, RFM), their symptoms and control. Design a climate-smart herd health calendar integrating heat-stress mitigation (shade, sprinklers, night feeding) and water-use efficiency strategies. • Apply WOAH five-domains animal welfare model to dairy herd management; describe low-stress handling (Temple Grandin races).	specimens/slides Vaccination calendar Health records	- Hoof trimming. • Identify common ecto-parasites (ticks, flies) and endo-parasites (fluke, roundworms) under microscope/hand lens. • Apply a control measure. • Design a 12-month dairy herd health calendar including vaccination, deworming, dry-off and calving dates. • Implement one heat-stress mitigation measure on the farm (e.g., shade installation check, adjust feeding time); • Demonstrate low-stress cattle handling through a handling race.	- Dehorning - Dipping/spraying for ectoparasites - Hoof trimming. • Identify common ecto-parasites (ticks, flies) and endo-parasites (fluke, roundworms) under microscope/hand lens; apply a control measure. • Design a 12-month dairy herd health calendar including vaccination, deworming, dry-off and calving dates. • Implement one heat-stress mitigation measure on the farm (e.g., shade installation check, adjust feeding time); Demonstrate low-stress cattle handling through a handling race.	trimmers Microscope Parasite slides/specimens Health calendar template Shade/cooling equipment Handling race

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

ETHICAL AND PROFESSIONAL PRACTICE

PROGRAMME: NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: ETHICAL AND PROFESSIONAL PRACTICE	**COURSE CODE: APT 425**	**CONTACT HOURS: 2 HOURS/WEEK**
	CREDIT UNIT: 2	**THEORETICAL: 2 HOURS/WEEK**
YEAR: II SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: HOURS/WEEK**
GOAL: This course is designed to equip students with the ethical, professional, legal and sustainability frameworks needed for responsible practice in the livestock and allied sectors to prepare technologists for ethical, professional and lifelong career practice.		

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

1.0 Understand foundational ethical theories and principles in animal production;
2.0 Know professional ethics in animal production practice;
3.0 Comprehend animal welfare principles in livestock management;
4.0 Know One Health principles and zoonotic responsibilities;
5.0 Understand research and publication ethics in scientific practice;
6.0 Know workplace ethics and professional conduct standards;
7.0 Appreciate business and entrepreneurial ethics in agribusiness;
8.0 Understand the Nigerian legal and regulatory framework in agriculture;
9.0 Know the application of contemporary animal welfare and AMR stewardship ethical frameworks;
10.0 Understand sustainability principles in animal production systems.

PROGRAMME: NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: ETHICAL AND PROFESSIONAL PRACTICE	COURSE CODE: APT 425	CONTACT HOURS: 2 HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: 2 HOURS/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL:
COURSE SPECIFICATION: THEORETICAL		
GOAL: This course is designed to equip students with the ethical, professional, legal and sustainability frameworks needed for responsible practice in the livestock and allied sectors to prepare technologists for ethical, professional and lifelong career practice.		
GENERAL OBJECTIVE 1.0: Understand foundational ethical theories and principles in animal production		

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Define ethics, morality, values, virtue, character, conscience and integrity; distinguish each concept clearly. 1.2 Differentiate descriptive ethics, normative ethics, meta-ethics and applied ethics with examples from animal production. 1.3 Outline major ethical theories. 1.4 Describe the four principles of bioethics. 1.5 Discuss the relationship between ethics, law, religion and culture in Nigerian agricultural	• Explain ethics and related terms; differentiate branches of ethics • Outline major ethical theories using a comparison chart • Describe bioethics principles with livestock examples (e.g. informed client consent, beneficence in disease control) • Discuss ethics, law, religion and culture in the Nigerian context • Describe ethical dilemmas and walk	Whiteboard, markers, projector; Ethical-theories comparison chart; Beauchamp & Childress — Principles of Biomedical Ethics; Banner — Ethics; Singer — Practical Ethics; African ethics readings (Ubuntu, Omoluabi); PLUS decision-making model			

	practice. 1.6 Describe ethical dilemmas. 1.7 Discuss the role of ethics in professions and why animal-production technologists need ethical frameworks. 1.8 Outline relevant Nigerian ethical and value foundations.	through the PLUS decision-making model using a farm case • Discuss the role of ethics in professions; outline Nigerian ethical foundations	handout; Internet and video clips			
General Objective 2.0: Know workplace ethics and professional conduct standards						
2-3	2.1 Define professional, professionalism and profession. 2.2 Describe the characteristics of a profession. 2.3 Explain the social contract between professions and society as the ethical basis of public trust in animal-health and production technologists. 2.4 Describe the elements of a professional code of conduct. 2.5 Explain specific ethical principles for animal-production technologists. 2.6 Describe truthful representation of qualifications, services and products. 2.7 Describe accountability	• Discuss professional terminology with Nigerian animal-production examples • Describe characteristics of a profession; compare to skilled trade using a table • Discuss the social contract; present a Nigerian case where public trust was broken (e.g. drug-adulteration scandal) • Describe code-of-conduct elements using NIAS, NSAP, VCN and ARCN codes	NIAS, NSAP, VCN and ARCN code-of-conduct documents; Projector, whiteboard; Nigerian drug-adulteration case study; NIAS CPD requirements document; Reference textbooks on professional ethics			

	and professional liability. 2.8 Explain continuing professional development (CPD) and lifelong learning.	• Discuss ethical principles for technologists using scenario-based examples • Describe truthful representation; discuss consequences of false claims under the NAFDAC Act • Describe accountability and liability; outline how NIAS handles professional misconduct • •Discuss CPD requirements under NIAS and NSAP; encourage personal development planning				
General Objective 3.0: Comprehend animal welfare principles in livestock management.						
4	3.1 Define animal welfare. 3.2 Discuss animal sentience. 3.3 Describe the Five Freedoms (Brambell 1965; FAWC 1979). 3.4 Describe the Five Domains model (Mellor 2015). 3.5 Describe WOAH (formerly OIE) terrestrial	• Discuss animal welfare and trace its evolution using a historical timeline • Discuss animal sentience using the Cambridge Declaration; present	Five Freedoms and Five Domains charts; WOAH terrestrial code welfare chapters; Welfare Quality protocol summary; Video clips: Grandin low-stress handling, halal			

	animal-welfare standards and their implications for Nigerian livestock exporters. 3.6 Discuss EU and emerging African Union animal-welfare frameworks. 3.7 Discuss animal-welfare assessment methods. 3.8 Describe ethical concerns in Nigerian. 3.9 Describe humane handling and transport (Grandin's principles). 3.10 Describe humane slaughter. 3.11 Explain the welfare of working animals in Nigeria. 3.12 Explain the moral status of farm animals. 3.13 Explain religious and cultural perspectives on animal welfare in Nigeria. 3.14 Describe the 3 Rs of alternatives to animal use in research.	neuroscience evidence • Describe the Five Freedoms using a chart; apply to a Nigerian poultry farm scenario • Describe the Five Domains model; contrast with Five Freedoms using a comparison table • Describe WOAH standards and their trade implications for Nigerian livestock exporters • Describe EU and AU welfare frameworks; link to international market access requirements • Discuss welfare-assessment methods using the Welfare Quality protocol summary • Describe ethical concerns in Nigerian production systems with	slaughter, battery cages; Cambridge Declaration on Consciousness (Low et al., 2012); Singer — Animal Liberation; Regan — The Case for Animal Rights; Webster — Animal Welfare; Mellor — Welfare Assessment; BROOKE Africa Nigeria working-animal case studies; Comparative religion table (Islamic, Christian, traditional); Projector, whiteboard			

		photographic evidence • Describe Grandin's handling principles; show video of low-stress handling system • Describe humane slaughter methods; discuss halal compliance with welfare safeguards • Discuss working-animal welfare using BROOKE Africa Nigeria case studies • Discuss Singer and Regan's moral status arguments; facilitate structured reflection • Discuss religious and cultural perspectives using a comparative religion table • • Describe the 3 Rs with examples relevant to				

		veterinary and livestock research in Nigeria				
General Objective 4.0: Know One Health principles and zoonotic responsibilities.						
5-6	4.1 Define One Health. 4.2 Discuss One Health drivers relevant to Nigeria. 4.3 Describe ethical responsibilities in One Health. 4.4 Discuss the animal-production technologist's role in One Health. 4.5 Describe zoonotic disease surveillance and reporting in Nigeria. 4.6 Describe ethical issues in vaccination programmes. 4.7 Describe ethical issues in food safety. 4.8 Describe ethical issues in vector-borne and emerging diseases. 4.9 Discuss climate change, animal disease, food security and ethics.	• Discuss One Health and describe its Quadripartite framework using a diagram • Discuss One-Health drivers relevant to Nigeria using NCDC and FMARD reports as evidence • Describe ethical responsibilities in One Health with emphasis on AMR stewardship • Discuss the technologist's role in One Health using a day-in-the-life scenario • Describe zoonotic disease surveillance and reporting using the Nigerian regulatory pathway • Describe vaccination-	One Health framework diagram (Quadripartite); NCDC and NVRI disease-surveillance reports; Nigerian notifiable disease list (FMARD/DVS); AMR stewardship guidelines (WHO, FAO); NAFDAC food-safety regulations; Climate-justice framework handout; Zinsstag — One Health: the Theory and Practice of Integrated Health Approaches; Projector, whiteboard, video clips of Lassa fever and HPAI response			

		programme ethics using COVID-19 and HPAI poultry culling examples • Describe food-safety ethics using mycotoxin and antibiotic-residue case studies • Describe vector-control and emerging-disease ethics • • Discuss climate change and food-security ethics; present a climate-justice framework for Nigerian smallholders				
General Objective 5.0: Understand research and publication ethics in scientific practice.						
7	5.1 Define research, research ethics and scientific misconduct (fabrication, falsification, plagiarism). 5.2 Describe historical foundations of research ethics. 5.3 Describe Institutional Animal Care and Use Committees (IACUC) and Institutional Review Boards (IRB) in Nigeria.	• Discuss research and research ethics; describe scientific-misconduct categories with examples • Describe historical foundations using a timeline; discuss why each code was created • Describe IACUC and IRB structures	Research-ethics timeline (Nuremberg Code to Belmont Report); Sample IACUC protocol form; 3 Rs framework chart; ICMJE authorship criteria document; COPE guidelines and flowcharts; Predatory journal			

	5.4 Describe the 3 Rs in detail. 5.5 Describe research-ethics principles. 5.6 Describe data ethics. 5.7 Describe publication ethics. 5.8 Describe ethics in student research. 5.9 Describe Committee on Publication Ethics (COPE) guidelines for authors, reviewers and editors. 5.10 Describe whistleblowing and reporting research misconduct. 5.11 Describe ethical use of AI in research.	in Nigeria; walk through a sample protocol-review process • Describe the 3 Rs with animal-production research examples • Describe research-ethics principles as applied to livestock and food-systems research • Describe data ethics; discuss open data, secure storage and FAIR principles • Describe publication ethics; explain ICMJE criteria; show examples of plagiarism and predatory journals • Describe ethics in student research; discuss supervisor responsibilities and student rights • Describe COPE guidelines; show COPE flowcharts for handling	examples (Beall's list extract); AI citation guidance (APA, MLA, COPE AI statement); Israel — Research Ethics for Social Scientists; Turnitin or Unicheck demonstration; Projector, whiteboard, computers			

		editorial complaints • Describe whistleblowing channels and whistleblower protection in Nigeria • Describe ethical AI use in research; discuss citation guidance and hallucination risks				
General Objective 6.0: Understand workplace ethics and professional conduct standards						
8	6.1 Describe the workplace as an ethical environment. 6.2 Describe diversity, equity and inclusion (DEI). 6.3 Describe harassment. 6.4 Describe conflict of interest. 6.5 Describe corruption, bribery and gift-giving conventions in Nigerian agricultural settings; describe the anti-corruption legal framework. 6.6 Describe nepotism and favouritism vs meritocracy. 6.7 Describe whistleblowing. 6.8 Describe occupational	•Describe workplace as an ethical environment; present the ethical-climate typology •Describe DEI in Nigerian livestock contexts; present inclusive-practice case studies •Describe harassment types, legal obligations under the 2016 Act, and reporting procedures •Describe conflict-of-interest types and disclosure	Nigerian Labour Act and National Minimum Wage Act extracts; Sexual Harassment Prohibition Act 2016 summary; EFCC and ICPC Act summaries; Whistleblower Protection Policy 2016 summary; Nigerian Factories Act OHS provisions; Sample HR and DEI policies from Nigerian agribusinesses;			

	health and safety (OHS) as an ethical responsibility. 6.9 Describe employment ethics. 6.10 Describe Nigerian Labour Law as it applies to farm labour. 6.11 Describe ethical leadership. 6.12 Describe organisational culture and ethical climate.	protocols •Describe corruption framework; present EFCC and ICPC enforcement data for agriculture •Describe nepotism vs meritocracy with Nigerian agri-enterprise examples •Describe whistleblowing protections and channels; discuss the ethics of silence •Describe OHS risks specific to Nigerian livestock operations; outline the Factories Act duties •Describe employment ethics; highlight child-labour risks in family livestock enterprises •Describe relevant provisions of Nigerian Labour Law for farm workers	OHS risk-assessment poster (farm zoonoses, chemical hazards); Greenberg — Behavior in Organizations; Projector, whiteboard			

		•Describe ethical leadership; contrast servant leadership with transactional leadership • Describe organisational culture and ethics audits; present a simple ethics-audit framework				
General Objective 7.0: Appreciate business and entrepreneurial ethics in agribusiness						
9-10	7.1 Discuss business ethics. 7.2 Describe ethical issues in Nigerian agribusiness. 7.3 Describe supply-chain ethics. 7.4 Describe pricing ethics. 7.5 Describe marketing ethics. 7.6 Describe ethical issues in livestock entrepreneurship. 7.7 Describe contract farming and out-grower scheme ethics. 7.8 Describe cooperative ethics. 7.9 Describe taxation ethics and compliance. 7.10 Describe intellectual property ethics. 7.11 Describe ethics in international trade.	•Discuss stakeholder and shareholder theories; apply to a Nigerian poultry-enterprise scenario •Describe agribusiness-ethics issues using recent Nigerian cases (adulterated feeds, mislabelled halal) •Describe supply-chain ethics with reference to AfCFTA and international buyer expectations •Describe pricing ethics; discuss price-gouging during COVID-19	Freeman — Strategic Management: A Stakeholder Approach; Crane & Matten — Business Ethics; AfCFTA trade framework summary; NAFDAC veterinary drug marketing regulations; Sample Nigerian agribusiness CSR report; Nigerian Cooperative Societies Act; NDPR (Nigeria Data Protection Regulation)			

	7.12 Describe ethical AI use in agribusiness.	food-supply disruptions in Nigeria •Describe marketing ethics; review NAFDAC regulations on veterinary drug claims •Describe livestock-entrepreneur ethics using a composite Nigerian SME case study •Describe contract farming ethics; use a smallholder broiler out-grower scheme as the example •Describe cooperative ethics with reference to Nigerian cooperative law •Describe taxation ethics; explain the difference between tax avoidance and evasion •Describe intellectual property ethics; discuss seed-patent	summary; Projector, whiteboard			

		implications for smallholder farmers •Describe AfCFTA and WTO trade ethics; discuss SPS standards and their welfare implications •• Describe AI ethics in agribusiness; discuss NDPR compliance for agritech apps				
General Objective 8.0: Understand the Nigerian legal and regulatory framework in agriculture						
11-12	8.1 Describe the Nigerian legal system. 8.2 Describe relevant Nigerian laws affecting animal production. 8.3 Describe relevant international conventions. 8.4 Describe registration and licensing of livestock enterprises in Nigeria. 8.5 Describe professional bodies relevant to animal-production technologists. 8.6 Describe NIAS registration 8.7 Describe NBTE accreditation of programmes.	• Describe the Nigerian legal system hierarchy using a pyramid diagram • Describe relevant laws using a table of law names, year, key provisions and implications for livestock technologists • Describe international conventions and Nigeria's treaty obligations	Nigerian legal-system pyramid diagram; Animal Diseases (Control) Act, NAFDAC Act, NESREA Act extracts; WOAH, Codex, CITES summaries; CAC, NAFDAC, SON, EIA registration guides; NIAS registration form and code of ethics; NBTE minimum standards document; Sample livestock-purchase			

	8.8 Describe professional liability. 8.9 Describe contract law as it applies to farm operations. 8.10 Describe land tenure and property law in Nigeria. 8.11 Describe livestock-related regulatory bodies.	• Describe enterprise registration processes step by step; use CAC, NAFDAC, SON, EIA as examples • Describe professional bodies using a comparative table (body, function, membership, relevance to HND graduates) • Walk through NIAS registration process using the actual application form • Describe NBTE accreditation process and minimum standards • Describe professional liability; work through a hypothetical negligence case involving livestock death • Describe contract	contract; Land Use Act 1978 extract; Regulatory-bodies jurisdiction map; Projector, whiteboard, professional-body brochures			

		law elements using a sample livestock-purchase contract • Describe land tenure; explain Certificate of Occupancy and its implications for farm financing • • Describe regulatory bodies using a jurisdiction map				
General Objectives 9.0: Know the application of contemporary animal welfare and AMR stewardship ethical frameworks						
13-14	9.1 Explain the evolution from FAWC Five Freedoms (1979) to the Mellor 5 Domains Welfare Model (2017/2020). 9.2 Describe the 5 Domains. 9.3 Outline WOAH Terrestrial Animal Health Code Section 7. 9.4 Describe the Welfare Quality® protocols. 9.5 Discuss Nigerian regulatory context. 9.6 List (CIA), WHO/FAO/WOAH Tripartite Action Plan 2024 update. 9.7 Describe Nigerian	• Discuss welfare-framework evolution. • Describe 5 Domains Model. • Outline WOAH Section 7 standards. • Describe Welfare Quality® protocols. • Discuss Nigerian regulatory framework • Outline AMR framework with WHO CIA list. • Describe Nigerian National Action	Mellor 5 Domains framework chart, WOAH Code Section 7 extracts, WHO Critical Importance List document, Nigerian National Action Plan on AMR, Prudent-use guidelines, Veterinary feed-directive examples, Welfare Quality®			

	National Action Plan on AMR 2024–2028 and the role of the AHPT/APT graduate. 9.8 Explain prudent-use principles for antimicrobials in livestock. 9.9 Outline the role of vaccination, biosecurity and herd health management in reducing antimicrobial demand. 9.10 Outline Antimicrobial Resistance framework (AMR).	Plan on AMR. • Explain prudent-use principles. • Discuss veterinary feed directives. • Outline role of vaccination and biosecurity	protocol guides, VCN Code of Ethics document			
General Objectives 10 .0: Understand sustainability principles in animal production systems						
15	10.1 Define sustainability. 10.2 Describe SDGs most relevant to livestock. 10.3 Describe Environmental, Social, and Governance (ESG). 10.4 Describe the carbon footprint of Nigerian livestock. 10.5 Describe climate justice. 10.6 Describe loss and damage. 10.7 Describe biodiversity ethics.	• Explain sustainability and the Triple Bottom Line; apply to a Nigerian livestock enterprise scenario • Describe the relevant SDGs using a livestock SDG wheel diagram; discuss Nigerian progress on each goal • Describe ESG reporting; show a	SDG livestock wheel diagram; Nigerian GHG inventory (FMARD, FAO-GLEAM data); Sample Nigerian agribusiness ESG scorecard; UNFCCC Loss and Damage Fund summary; Indigenous livestock breed data (NAPRI,			

	10.8 Describe water ethics. 10.9 Describe land-use ethics. 10.10 Describe gender and youth in livestock production. 10.11 Describe technology and ethics in livestock. 10.12 Describe AI ethics in agribusiness. 10.13 Discuss the changing role of the animal-production technologist. 10.14 Discuss the moral character of a successful Technologist.	sample ESG scorecard from a Nigerian agribusiness • Describe the carbon footprint of Nigerian livestock using national GHG inventory data; present ethical mitigation options • Describe climate justice; present data on Nigerian smallholder and pastoralist climate vulnerability • Describe loss and damage; explain the UNFCCC fund and its relevance to Nigerian agriculture • Describe biodiversity ethics; present data on threatened Nigerian indigenous livestock breeds • Describe water ethics; present the water footprint of major livestock	NBRI); Livestock water-footprint data (Mekonnen & Hoekstra, 2012); Herder-farmer conflict data (IPCR, Mercy Corps); CRISPR ethics paper; FAO cultivated-meat report; NDPR summary; Brundtland — Our Common Future; Projector, mobile devices, internet, video clips			

		products • Describe land-use ethics; discuss herder-farmer conflict using published Nigerian case data • Describe gender and youth in livestock; present FMARD gender and youth statistics • Describe emerging technology ethics; walk through CRISPR, PLF, cloning and lab-grown meat • Describe AI ethics in agribusiness; discuss NDPR and algorithmic-bias examples • Discuss the changing role of the technologist using a 2030 skills-gap framework • • Discuss moral character using a Nigerian role-model case study				
Course Assessment: Course work: 20%						

Test/Assignments: 20% Examination: 60% **Total: 100%**

LIVESTOCK FINANCING

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY		
COURSE TITLE: LIVESTOCK FINANCING	**COURSE CODE: APT 426**	**CONTACT HOURS: 2 HOURS/WEEK**
	CREDIT UNIT: 2	**THEORETICAL: 1 HOUR/WEEK**
YEAR: II SEMESTER: II	**PRE-REQUISITE:**	**PRACTICAL: 1 HOUR/WEEK**

GOAL: This course is designed to equip students with the Knowledge and skills on livestock financing and financial management skills for sustainable animal production enterprises.

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

1.0 Understand the principles and importance of livestock financing in animal production enterprises;
2.0 Know the sources and types of agricultural finance available to livestock enterprises;
3.0 Understand budgeting and financial planning techniques in livestock production systems;
4.0 Understand financial records and statements;
5.0 Know loan requirements, credit facilities, and repayment plans for livestock enterprises;
6.0 Understand cost-benefit analysis and investment appraisal techniques in livestock projects;
7.0 Know the application of AfCFTA, halal certification and premium-market value-chain competencies;
8.0 Comprehend risks and insurance options in livestock production enterprises;
9.0 Know the use of financial management tools for decision-making in animal production systems.

PROGRAMME: HIGHER NATIONAL DIPLOMA ANIMAL PRODUCTION TECHNOLOGY					
COURSE TITLE: LIVESTOCK FINANCING		**COURSE CODE: APT 426**		**CONTACT HOURS: 2 HOURS/WEEK**	
		CREDIT UNIT: 2		**THEORETICAL: 1 HOUR/WEEK**	
YEAR: II SEMESTER: II		**PRE-REQUISITE:**		**PRACTICAL: 1 HOUR/WEEK**	
COURSE SPECIFICATION: THEORETICAL					
GOAL: This course is designed to equip students with the Knowledge and skills on livestock financing and financial management skills for sustainable animal production enterprises.					
GENERAL OBJECTIVE 1.0: Understand the principles and importance of livestock financing in animal production enterprises					
THEORETICAL CONTENT				**PRACTICAL CONTENT**	
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**
1	1.1 Define livestock financing and agricultural finance. 1.2 Explain the principles of livestock financing. 1.3 Differentiate short-term, medium-term, and long-term financing.	• Explain livestock financing and agricultural finance • Discuss the principles of livestock financing in animal production enterprises • Describe the difference between short-term, medium-term, and long-term financing	Whiteboard and markers Lecture notes Agricultural finance textbooks Charts showing financing types and principles Case studies on livestock enterprises	• Identify the importance of financing in livestock production systems. • Assess financial needs in different animal production enterprises. • Analyze the role of finance in improving livestock productivity and enterprise growth.	Guide students to: • Identify financing needs in livestock enterprises • Analyse financing case studies • Assess financial requirements for livestock projects • Participate in group discussions on financing challenges and solutions • Participate in practical exercises on financing scenarios in animal production	Sample livestock enterprise budgets Financial case study materials Calculators Spreadsheet software (optional) Computers/projector for demonstrations Worksheets and notebooks
General Objective 2.0: Know the sources and types of agricultural finance available to livestock enterprises						

2	2.1 List agricultural finance and livestock financing institutions in Nigeria and international. 2.2 Classify agricultural finance into short-term, medium-term, and long-term finance. 2.3 Differentiate between formal and informal financing sources. 2.4 Explain the functions of agricultural financial institutions.	• Discuss the agricultural finance and livestock financing institutions in Nigeria and international • Classify agricultural finance into short-term, medium-term, and long-term finance • Differentiate between formal and informal financing sources • Explain the functions of agricultural financial institutions	Whiteboard and markers Lecture notes Agricultural finance textbooks Charts showing types and sources of finance Case studies on livestock financing	•Identify sources of agricultural finance available to livestock enterprises. •Assess the suitability of different financing sources for livestock enterprises. •Select appropriate financing options for specific animal production activities.	Guide students to: •Identify financing sources for different livestock enterprises •Classify financing types based on duration and purpose •Assess financing options using case studies •Participate in group discussions on access to agricultural credit •Participate in practical exercises on selecting suitable finance sources for livestock businesses	Sample loan application forms Financial institution brochures Calculators Spreadsheet software (optional) Computers/projector for demonstrations Worksheets and notebooks Internet access (optional)
General Objective 3.0: Understand budgeting and financial planning techniques in livestock production systems						
3	3.1 Define budgeting and financial planning in livestock production. 3.2 Explain the importance of budgeting in animal production enterprises. 3.3 Differentiate	• Explain budgeting and financial planning in livestock production • Discuss the importance of budgeting in animal production enterprises • Explain the difference between	Whiteboard and markers Lecture notes Farm management and agricultural finance textbooks Charts showing budget formats and	• Identify types of farm budgets used in livestock enterprises. • Prepare enterprise and partial budgets for livestock production systems. • Estimate production costs	Guide students to: • Prepare enterprise and partial budgets for livestock enterprises • Estimate production costs and revenues • Analyse budget data using spreadsheets or calculators • Participate in	Desktop or laptop computers Spreadsheet software (e.g., Microsoft Excel, Google Sheets) Calculators Budget templates and worksheets Sample livestock enterprise data

	between enterprise budgets and partial budgets. 3.4 Analyze budget outcomes for livestock enterprise management.	enterprise budgets and partial budgets • Describe budget outcomes for livestock enterprise management	financial planning processes Sample farm records and case studies	and expected returns in livestock enterprises. • Apply budgeting techniques for financial planning and decision-making.	practical exercises on financial planning scenarios • Participate in budgeting exercises for poultry, fishery, or livestock projects • Apply budgeting results to farm decision-making	Projector for demonstrations Reliable power supply/backup
General Objective 4.0: Understand financial records and statements						
4-5	4.1 Define farm financial records and financial statements. 4.2 Explain the importance of financial records in livestock enterprise management. 4.3 Differentiate between income statements, balance sheets, and cash flow statements. 4.4 Analyze farm financial statements for decision-making. 4.5 Interpret financial information from livestock enterprise records.	• Explain farm financial records and financial statements • Discuss the importance of financial records in livestock enterprise management • Explain the difference between income statements, balance sheets, and cash flow statements • Explain farm financial statements for decision-making • Describe financial information from livestock enterprise records	Whiteboard and markers Lecture notes Agricultural finance and farm management textbooks Charts showing financial statement formats Sample livestock financial records and reports	• Identify types of farm financial records and statements used in animal production. • Prepare basic farm financial records and statements • Record farm income and expenditure data. • Analyse financial records using spreadsheets or calculators. • Participated in practical exercises on farm financial analysis. • Participate in case studies involving livestock enterprise accounts.	Guide students to: • Identify types of farm financial records and statements used in animal production • Prepare basic farm financial records and statements • Record farm income and expenditure accurately • Prepare simple farm financial records and statements • Record farm income and expenditure data • Analyse financial records using spreadsheets or calculators • Participated in practical exercises on farm financial analysis	Desktop or laptop computers Spreadsheet software (e.g., Microsoft Excel, Google Sheets) Calculators Farm record templates and worksheets Sample livestock enterprise financial data Projector for demonstrations Reliable power supply/backup

				• Interpret financial results for farm management decisions.	• Participate in case studies involving livestock enterprise accounts • Interpret financial results for farm management decisions	
General Objective 5.0: Know loan requirements, credit facilities, and repayment plans for livestock enterprises.						
6-7	5.1 Define agricultural credit, loan requirements, and repayment plans. 5.2 Explain the importance of credit facilities in livestock enterprises. 5.3 Differentiate between types of credit facilities available to livestock farmers. 5.4 Recommend appropriate repayment plans for livestock enterprises.	• Explain agricultural credit, loan requirements, and repayment plans • Explain the importance of credit facilities in livestock enterprises • Differentiate between types of credit facilities available to livestock farmers • Recommend appropriate repayment plans for livestock enterprises	Whiteboard and markers Lecture notes Agricultural finance and farm management textbooks Charts showing financial statement	•Identify requirements for obtaining agricultural loans. •Assess loan conditions and repayment terms for livestock enterprises. •Calculate loan interest and repayment schedules. • Evaluate suitability of credit facilities for specific livestock projects.	Guide students to: •Analyse loan application requirements •Calculate loan interest and repayment schedules •Evaluate credit options using livestock enterprise case studies •Participate in practical exercises on repayment planning •Participates in loan analysis activities for different livestock projects •Recommend suitable repayment plans based on enterprise capacity	Sample agricultural loan application forms Loan repayment schedule templates Financial calculators (manual or digital) Spreadsheet software (Microsoft Excel, Google Sheets) Computers/laptops for financial analysis Case study materials on livestock financing Sample bank credit policy documents Microfinance and agricultural bank brochures Worksheets for

						loan calculation and repayment planning Projector for demonstrations Internet access (for current loan schemes and policies) Sample livestock enterprise financial data Loan interest calculation charts/formulas Budget and cash flow templates
General Objective 6.0: Understand cost-benefit analysis and investment appraisal techniques in livestock projects.						
8-9	6.1 Explain the importance of investment appraisal in livestock project evaluation. 6.2 Differentiate between fixed and variable costs in animal production systems. 6.3 Analyze investment options using appraisal techniques such as gross margin and	• Explain the importance of investment appraisal in livestock project evaluation • Differentiate between fixed and variable costs in animal production systems • Analyze investment options using appraisal techniques such as gross margin and break-even analysis	Lecture notes Agricultural finance and farm management textbooks Charts showing investment appraisal methods Sample livestock enterprise case studies	• Identify components of costs, benefits, and investment returns in livestock projects. • Calculate costs, returns, and profitability of livestock projects. • Apply cost-benefit analysis techniques to livestock enterprises. • Evaluate the feasibility and	Guide students to: • Calculate production costs and expected returns for livestock projects • Apply cost-benefit analysis techniques using enterprise data • Analyse profitability and investment options • Participate in practical exercises on gross margin and break-even analysis • Participate in	Desktop or laptop computers Spreadsheet software (e.g., Microsoft Excel, Google Sheets) Financial calculators Cost-benefit analysis templates Sample livestock production and financial data Projector for demonstrations Reliable power

	break-even analysis.			profitability of livestock projects.	feasibility assessment activities for livestock enterprises • Evaluate project viability using financial data	supply/backup
General Objective 7.0: Know the application of AfCFTA, halal certification and premium-market value-chain competencies						
10-11	7.1 Outline AfCFTA framework. 7.2 Describe Nigerian livestock-export value chains. 7.3 Explain Nigerian Export Promotion Council (NEPC) export procedures, NACCIMA, NEXIM, Nigerian Customs. 7.4 Describe halal certification. 7.5 Discuss EU/USA/Middle East/Asian halal-market access requirements. 7.6 Describe organic certification. 7.7 Explain digital	• Outline AfCFTA framework with sectoral data. • Describe export value chains. • Explain NEPC procedures. • Describe halal certification. • Discuss international market-access requirements • Describe organic certification frameworks. • Explain digital marketing channels. • Outline QR-code traceability. • Describe premium-retail integration. • Discuss livestock-	AfCFTA framework document, NEPC procedures guide, Halal certification framework documents, OIC/SMIIC standards, EU/USA/Middle East market-access guides NOAN/EU/USDA/IFOAM standards documents, Digital marketing platform guides,	• Compose a complete AfCFTA livestock-export business plan. • Draft NEPC export-permit application. • Develop a halal-certification plan for a meat processor. • Set up WhatsApp Business catalogue with at least 6 products. • Generate QR-codes for product traceability. • Compose a premium-retail pitch to one Nigerian retail chain. • Develop a livestock-finance	Guide students to: Compose AfCFTA business-plan. • Draft NEPC application. • Develop halal-certification plan. Setup WhatsApp Business setup. • Generate QR-code. • Compose retail-pitch composition. • Develop finance-application package development.	AfCFTA business-plan templates, NEPC application templates, Halal certification checklists. Smartphones, internet, QR-code generators, Pitch templates, BOI/NIRSAL application templates.

	marketing channels. 7.8 Outline QR-code traceability for premium products. 7.9 Describe premium-retail integration.	finance instruments.	QR-code generation tools, Premium-retail chain contacts, BOA/BOI/NIRSAL/NACRDB product guides.	application package for BOI/NIRSAL.		
General Objective 8.0: Comprehend risks and insurance options in livestock production enterprises.						
12-13	8.1 Explain the importance of risk management and insurance in animal production systems. 8.2 Differentiate between insurable and non-insurable risks in animal production. 8.3 Analyze available livestock insurance options and policies. 8.4 Explain appropriate risk management and insurance strategies for livestock enterprises. 8.5 Explain risk and	• Discuss the importance of risk management and insurance in animal production systems • Explain the difference between insurable and non-insurable risks in animal production • Discuss available livestock insurance options and policies • Describe appropriate risk management and insurance strategies for livestock enterprises	Lecture notes Whiteboard and markers Agricultural finance and insurance textbooks Charts showing risk categories and insurance systems Sample insurance policy document	• Identify common risks associated with livestock enterprises. • Assess risk factors affecting livestock production enterprises. • Evaluate the effectiveness of insurance options in reducing farm losses.	• Guide students to: • Identify risks in livestock production scenarios • Analyse insurance policy documents and case studies • Assess risks associated with different livestock enterprises • Participate in practical exercises on selecting suitable insurance options • Develop simple risk management plans • Recommend insurance strategies for livestock businesses	Livestock enterprise case studies Risk assessment templates Insurance policy samples and brochures Computers/projector for demonstrations Worksheets and calculators Reliable power supply/backup

	insurance in livestock production enterprises.					
General Objective 9.0: Know the use of financial management tools for decision-making in animal production systems						
14-15	9.1 Define financial management tools used in animal production systems. 9.2 Explain the role of financial management tools in farm decision-making. 9.3 Differentiate between various financial management tools and their applications. 9.4 Interpret financial results for effective farm management decisions.	• Explain financial management tools used in animal production systems • Discuss the role of financial management tools in farm decision-making • Explain the difference between various financial management tools and their applications • Discuss financial results for effective farm management decisions	Whiteboard and markers Lecture notes/handouts Agricultural finance and farm management textbooks Charts showing financial tools and decision frameworks Sample financial statements and case studies	• Identify common financial tools used in livestock enterprises (budgets, cash flow, spreadsheets, ratios). • Apply financial management tools in livestock enterprise planning and analysis. • Compute key financial indicators such as profit, gross margin, and break-even point. • Analyze financial data to support livestock production decisions.	Guide students to: • Prepare simple farm budgets using financial tools • Use spreadsheets to analyze livestock financial data • Compute financial indicators (profit, margin, break-even) • Participate in practical exercises on cash flow planning and analysis • Participate in case studies on financial decision-making in livestock enterprises • Interpret financial results for farm management decisions	Desktop or laptop computers Spreadsheet software (e.g., Microsoft Excel, Google Sheets) Financial calculators Sample livestock enterprise financial data Budget and cash flow templates Projector for demonstrations Reliable power supply/backup
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40%						

Examination:	40%
Total:	**100%**

LIST OF MINIMUM RESOURCES/PHYSICAL FACILITIES

a.Computer Laboratory

S/No	DESCRIPTION OF ITEMS.	QUANTITY REQIURED
1.	Laptop computer	40
2.	Projector	2
3.	PV Solar power	1
4.	Internet	1
5.	Printers	2
6.	Scanners	2
7.	Stabilizers	40
8.	Fan	4
9.	Split Unit Air Conditioner	4
10.	Work station	4
11.	Screen board	1
12.	Memory cards	60
13.	Flash drives	100
14.	Office suite software	Assorted
15.	Calculators	60
16.	Graphsheets	170
17.	Clipboard	30
18.	Whiteboard/Marker	1
19.	Labcoat	80
20.	Public Address system	1

b. Waste Management and Biosecurity Laboratory

S/No	DESCRIPTION OF ITEMS.	QUANTITY REQIURED
1.	Waste bins	10
2.	Incinerators	11
3.	Composting units	10

4.	Manure handling systems	10
5.	Biogas digesters	8
6.	Effluent disposal systems	7
7.	Foot dips	9
8.	Hand washing stations1	7
9.	Disinfection tunnels	7
10.	Protective overallswan	100
11.	Gloves and boots	100
12.	Face masks and shields	100
13.	Quarantine pens	70
14.	Carcass disposal units	20

c. Animal Farm Mechanization Laboratory

S/N	**DESCRIPTION OF ITEMS.**	**QUANTITY REQUIRED**
1.	Multi-purpose tractors	6
2.	Tractor implements	6
3.	Disc ploughs	6
4.	Harrows	6
5.	Ridgers	6
6.	Seed drills	6
7.	Trailers	6
8.	Front-end loaders	6
9.	Forage harvesters	4
10.	Hammer mills	10
11.	Feed grinders	11
12.	Feed mixers	12
13.	Disc mowers	12
14.	Balers	5
15.	Chaff cutters	7
16.	Silage making machines	5
17.	Hay balers	4
18.	Hay rakes	7

19.	Fodder choppers	7
20.	Manure spreaders	7
21.	Water bowsers	7
22.	Power tillers	7
23.	Generator-powered sprayers	6
24.	GPS-guided machinery	5
25.	Farm drones for monitoring	5

d. Feed Milling and Nutrition Laboratory

S/NO	DESCRIPTION OF ITEMS.	QUANTITY REQUIRED
1.	Feed milling machines	5
2.	Pelletizers	5
3.	Feed formulation software	5
4.	Precision feed formulation systems	6
5.	Feed ingredient storage bins	7
6.	Feed weighing balances	11
7.	Moisture analyzers	11
8.	Laboratory weighing balances	11
9.	Feed grinders	11
10.	Feed mixers	11
11.	Kjeldahl digestion apparatus	12
12.	Kjeldahl distillation unit	5
13.	Soxhlet extraction apparatus	10
14.	Muffle furnace	5
15.	Hot air oven	5
16.	Bomb calorimeter	7
17.	Spectrophotometer	7
18.	pH meter	7
19.	Centrifuge	7
20.	Water bath	7
21.	Desiccator	7

22.	Magnetic stirrer	7
23.	Laboratory glassware	10
24.	Reagent bottles	10
25.	Sample containers	10
26.	Feed sampling probes	10
27.	Laboratory refrigerators	5
28.	Laboratory freezers	5
29.	Microscopes	5
30.	Digital nutrient analyzers	5
31.	Near Infrared Spectroscopy (NIRS) analyzer	5

e. Teaching, Demonstration and Research Laboratory

S/No	DESCRIPTION OF ITEMS	QUANTITY REQUIRED
1.	Anatomical models	10
2.	Animal skeleton models	10
3.	Charts and teaching aids	10
4.	Multimedia teaching systems	10
5.	Demonstration farms	4
6.	Research pens	4
7.	Simulation software	4
8.	Digital learning platforms	4
9.	Smart boards	5
10.	Research data collection devices	5
11.	Survey and monitoring tools	20

f. Apiculture and Mini-Livestock Laboratory

S/NO	DESCRIPTION OF ITEMS	QUANTITY REQUIRED
1.	Beehives	5
2.	Honey extractors	5
3.	Bee suits and gloves	10

4.	Smokers	10
5.	Hive tools	10
6.	Honey storage containers	12
7.	Snailery pens	10
8.	Grasscutter cages	10
9.	Rabbit hutches	10
10.	Mini-livestock feeders and drinkers	10

g. Meat Processing and Abattoir

S/No	DESCRIPTION OF ITEMS.	QUANTITY REQUIRED
1.	Slaughter slabs	2
2.	Electric stunners	5
3.	Carcass saws	5
4.	Meat cutting tables	5
5.	Knives and sharpening tools	20
6.	Dehairing machines	10
7.	Skinning equipment	10
8.	Meat mincers	10
9.	Meat grinders	10
10.	Meat smoking units	10
11.	Meat drying equipment	10
12.	Cold rooms	5
13.	Refrigerated storage units	5
14.	Blast freezers	5
15.	Vacuum packaging machines	10
16.	Meat weighing scales	20
17.	Carcass hooks and rails	20
18.	Sterilization tanks	10
19.	Waste disposal systems	5
20.	Effluent treatment systems	5
21.	Meat inspection kits	10
22.	Hides and skin processing equipment	10

h. Pasture and Range Management

S/NO	DESCRIPTION OF ITEMS.	QUANTITY REQUIRED
1.	Forage harvesters	5
2.	Disc mowers	5
3.	Balers	5
4.	Irrigation systems	5
5.	Grass cutters	5
6.	Soil testing kits	5
7.	Pasture seeders	5
8.	Fodder conservation equipment	5
9.	Silage bags and silos	10
10.	Hay storage facilities	5
11.	Pasture moisture meters	5
12.	Drone mapping systems	5

i. Sheep and Goat Management

S/NO	DESCRIPTION OF ITEMS.	QUANTITY REQUIRED
1.	Shearing equipment	20
2.	Drenching guns	20
3.	Hoof trimming kits	20
4.	Sheep handling crates	20
5.	Goat milking equipment	20
6.	Portable fencing systems	10
7.	Grazing management tools	10
8.	Mineral lick dispensers	10

j. Poultry Production and Hatchery

S/NO	DESCRIPTION OF ITEMS.	QUANTITY REQUIRED

1.	Egg incubators	5
2.	Hatchery units	5
3.	Automatic hatchery systems	5
4.	Brooders	5
5.	Candling machines	5
6.	Egg trays	200
7.	Egg graders	100
8.	Egg washing machines	10
9.	Egg storage refrigerators	5
10.	Chick boxes	5
11.	Poultry feeders	100
12.	Poultry drinkers	100
13.	Battery cages	5
14.	Poultry weighing scales	50
15.	Ventilation fans	50
16.	Climate-controlled poultry systems	30
17.	Poultry vaccination equipment	100
18.	Poultry debeakers	100
19.	Feed troughs	100
20.	Litter management equipment	100

k. Dairy Production Equipment

S/N	DESCRIPTION OF ITEMS	QUANTITY REQUIRED
1	Milking parlors	5
2	Vacuum milking machines	5
3	Milk cans	50
4	Milk storage tanks	10
5	Milk cooling tanks	10
6	Pasteurizers	10
7	Sterilizers	10
8	Cream separators	3

9	Milk analyzers	5
10	Butter churners	5
11	Cheese processing equipment	5
12	Yogurt processing equipment	5
13	Dairy hygiene kits	5
14	Udder washing systems	5
15	Somatic cell counters	5
16	Dairy laboratory kits	20
17	Refrigerated transport units	5

l. Swine Production Equipment

S/N	**DESCRIPTION OF ITEMS**	**QUANTITY REQUIRED**
1	Farrowing crates	20
2	Piglet creep feeders	20
3	Automatic pig feeders	10
4	Nipple drinkers	10
5	Swine weighing scales	10
6	Pig handling boards	10
7	Pig restraining equipment	10
8	Pig waste management systems	10
9	Swine housing ventilation systems	10
10	Swine heating systems	10
11	Artificial insemination kits for pigs	10

LIST OF WORKSHOP PARTICIPANTS

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