



Harvest

University

est. 2014

School of Agricultural and Environmental Sciences

Department of Animal Sciences

Curriculum for Bachelor of Science in Animal Science and Production (BSc. ASP)

HARVEST UNIVERSITY
Yielding Leaders

THE KINGDOM. THE POWER. THE GLORY

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1 **1.0 INTRODUCTION**

2 This document is a programme description of the **Bachelor of Animal Science and**
3 **Production** in the School of Agricultural Sciences of Harvest University. This Programme
4 has been designed for both pre-service and in-service candidates who would want to be
5 either entrepreneurs or working in private or public agricultural sectors. The programme is
6 a single major. The programme is specifically designed and developed to produce graduates
7 who will be grounded in both theory and practical. Through this programme, it is anticipated
8 that the quality of Agricultural entrepreneurs and service delivery to the public will
9 improve.

10 **Rationale of the Programme**

11 Agriculture in Zambia is one of the key priority sectors that contribute to economic growth
12 and poverty reduction. It currently accounts for about 22% of Gross Domestic Product
13 (GDP) and provides livelihood for more than 50% of the population. The agricultural sector
14 has also emerged as an important foreign exchange earner. Currently, the Livestock sub
15 sector contributes 42% and 3.5% to the Agriculture and GDP respectively. The livestock
16 sub sector has great potential. Zambia has abundant arable land not fully utilized for
17 livestock Aquaculture production. 40% of the natural water bodies in the Southern region
18 lies in Zambia. The country has huge domestic and regional market for both livestock and
19 aquacultural products.

20 The Government of the Republic of Zambia in its bid to achieve the Vision 2030, has put
21 into place a number of agricultural development frameworks: The Vision 2030 gives the
22 Zambian people the impetus to be a prosperous middle-income nation by the year 2030.
23 The vision recognizes that effective delivery of agricultural services is a key to increased
24 agricultural production and productivity especially among small scale farmers (Vision,
25 2030). The Seventh National Development Plan (SNDP) is an investment plan with focus
26 on rural development and job creation, and alludes to improved sustainable and efficient
27 production, productivity and value addition of a diversified agricultural sector through
28 enhancement of Extension Service Delivery. The National Agricultural Policy (NAP) on

29 the other hand, encompasses the key facets of livestock and aquaculture for they serve as a
30 guide to the development of the agricultural sector.

31 This programme is therefore, designed to train scientists who will not only acquire scientific
32 knowledge and skills but also acquire entrepreneurial skills to start up a business; produce
33 someone who challenges himself or herself by looking at things differently thereby,
34 challenging the existing system to move livestock and aquaculture production to the next
35 higher levels in the value chains.

36

37 **2.0 PROGRAMME MISSION STATEMENT AND VISION**

38 **2.1 Mission Statement**

39 Harvest University is committed to creating and enriching the academic, personal and
40 professional growth and at the same time disseminating knowledge leading to academic and
41 research excellence along with developing individuals for a better tomorrow.

42

43 **2.2 Vision**

44 Harvest University thrives on Christian values and fosters lifelong academic excellence. In this
45 regard, Harvest University strives to move towards becoming a world-class university with a
46 transformative impact on society and economic development through continual innovation in
47 higher education, research, creativity and entrepreneurship.

48

49 **3.0 INSTITUTIONAL VALUES**

50 Harvest University underpins and upholds the following values in the provision of tertiary
51 education:

52

53 **3.1. Quality and Excellence:**

54 Harvest University is committed to providing quality product or service and excellence in all
55 disciplines that fall under its jurisdiction. The Harvest University believes in the provision of
56 the service that is excellent, adequate, dependable and economic to students. In providing this
57 mandate, it calls for hard work by students, lecturers and supportive staff of Harvest University

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61

62 **3.2 Integrity, Trust, and Respect:**

63 Harvest University is committed to ensuring trust and respect for all persons in an environment
64 becomes an integral part of our leadership. As an institution that cultivates Christian values,
65 Harvest University strives to achieve institutional integrity in providing higher education to local
66 and international students.

67
68 **3.3 Research, Innovation, and Creativity:**

69 Harvest University is committed to the pursuit of inquiry and discovery and to the creation and
70 dissemination of knowledge.

71
72 **3.4 Freedom of Expression:**

73 Harvest University is committed to the free exchange of ideas in a constructive and civil
74 environment, including the canons of academic freedom in research, teaching, and outreach.

75
76 **3.5 Stewardship and Accountability:**

77 The Harvest University is committed to serving as ethical and responsible stewards of University
78 resources. In order to achieve good corporate governance and quality assurance in managing
79 human and other resources, transparent and prudent decisions are key to the growth of the
80 university.

81

82 **4.0 PROGRAMME AIMS AND OBJECTIVES**

83 **4.1 Aim of the Programme**

84 The aim is to produce scientists and professionals who will contribute meaningfully to the
85 development of the livestock industry in Zambia and beyond. In addition, this programme
86 is designed to produce graduates that are able to apply practical skills and theoretical
87 knowledge in animal science and production sustainably.

88

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91

92 **4.2 Objectives of the Programme**

93 By the end of the programme, graduates should be able to:

- 94 1) Integrate the knowledge and skills required to efficiently manage aquaculture, dairy,
95 beef, sheep, goat, poultry, and pig production.
- 96 2) Demonstrate the ability to think clearly and critically about farm management issues
97 and problems, and make appropriate decisions in different situations.
- 98 3) Communicate effectively, both orally and in writing, and integrate appropriate
99 management techniques, such as milking, feeding, young animal care, breeding,
100 assisted reproductive techniques, and disease control into production operations.
- 101 4) Recognize the importance and exploit the role of genetics, physiology, nutrition,
102 health, and other factors that contribute to the efficiency and quality of animal and
103 aquaculture production.
- 104 5) Effectively use appropriate ICT applications to increase the efficiency of enterprises.

105

106 **5.0 CURRICULUM**

107 Curriculum is dynamic and will be evaluated and revised every five years after
108 engaging stakeholders for critical analysis and needs evaluation. Furthermore, it is
109 developed to permit, as new developments emerge and necessitate change for individual
110 courses.

111 **5.1 Programme Learning Outcomes**

112 The key learning outcomes of this programme are graduates of the programme who will be
113 able, *inter alia*, to:

- 114 1) Demonstrate appropriate abilities, knowledge, skills, attitudes and values that will
115 enable them manage the livestock and fish industries as well as dissemination of
116 appropriate and sustainable innovations to farmers; and

- 117 2) Exhibit knowledge and skills in conducting scientific research in animal and
118 aquaculture science and production, thereby, enable them contribute to the world's
119 body of scientific knowledge.
- 120 3) Exhibit knowledge and critical understanding of well-established principles of
121 emerging issues in animal and aquaculture science and production of the way in which
122 those principles have developed.
- 123 4) Demonstrate the ability to apply underlying concepts and principles outside the
124 context in which they were first studied, including, where appropriate, the application
125 of those principles in varied contexts thereby allowing for crosspollination of ideas
126 across disciplines
- 127 5) Demonstrate an understanding of both pedagogical and andragogical knowledge and
128 skills necessary for teaching the farmers modern and improved farming methods.
- 129 6) Effectively interpret the agriculture policy and use it to develop tailor-made
130 agricultural innovations.
- 131 7) Develop a holistic approach to problem solving affecting livestock and fish
132 farmers.
- 133 8) Promote creativity, innovation and analytical skills for effective extension
134 delivery
- 135 9) Apply improvisation by the use of natural and artificial materials.
- 136 10) Explain the limits of their knowledge, and how this influences analysis and
137 interpretations based on that knowledge.
- 138 11) Acquire skills needed to study further with a high level of autonomy.
- 139 12) Demonstrate competence and ability to be able to apply entrepreneurial skills on the
140 farm.
- 141 13) Acquire practical skills on planning, monitoring and evaluating skills for effective
142 extension programs.

143 **5.2 Level of Qualification and Articulation in the Zambia Qualifications Framework**

144 **ZQF**

145 **Level: 7**

146

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6.0 CURRICULUM MAP

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SEMESTER 1		YEAR ONE	SEMESTER II	
MAT111	Introductory Mathematics		ANS112	Introduction to Agriculture
PHY121	Introductory Physics		AEC122	Farm Accounts and Introduction to Agricultural Economics
CHE131	Introductory Chemistry		ANS132	Introduction to Agricultural Botany
BIO 141	Introductory Biology		BIO142	Zoology
COM115	Communication and Computer Skills		MAT152	Biometry
SEMESTER 1		YEAR TWO	SEMESTER II	
ANS211	Fundamentals of Animal Anatomy and Physiology I		ANS212	Fundamentals of Animal Anatomy and Physiology II
CHE221	Animal Biochemistry		AEN222	Farm Structures
AEN231	Principles of Agro-Climatology		AEN232	Climate Change and Variability
AEC241	Entrepreneurship and Innovation		AEN242	Field Crop Production
ANS251	Animal Genetics		AEN252	Farm Management
			AEN262	Field Attachment I
SEMESTER I		YEAR THREE	SEMESTER II	
ANS311	Fundamentals of Aquaculture		ANS312	Poultry Production
ANS321	Principles of Animal Nutrition		ANS322	Animal Growth and Development
ANS331	Animal Health		ANS332	Applied Animal Nutrition
ANS341	Sheep, Goat and Rabbit Production		ANS342	Veterinary Epidemiology and Biostatistics
ANS351	Analysis for Agricultural Research		ANS352	Pig Production

ANS361	Field Attachment II			
SEMESTER I		YEAR FOUR	SEMESTER II	
ANS411	Animal Breeding		AEC412	Agricultural Extension and Rural Sociology
ANS421	Pasture Management and Forage Production		ANS422	Range Management
ANS431	Beef production		ANS432	Dairy Production
ANS411	Aquaculture Production and Management		ANS442	Animal Products and By-Products
ANS451	Applied Animal Reproduction		ANS452	Research project

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7.0 TEACHING AND LEARNING PLAN (BACHELOR OF SCIENCE IN ANIMAL SCIENCE AND PRODUCTION)

First Year Courses

COURSE CODE	COURSE TITLE	CONTACT HOURS													CREDIT POINTS
		Lectures		Tutorials		Laboratory		Seminars		Field Work		Assessments and Self Study		Total Hours	
		Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks		
MAT110	Introductory Mathematics	3	30	3	30	0	0	0	0	0	0	1	30	210	21.0
CHE120	Introductory Chemistry	3	30	1	30	3	30	0	0	0	0	1	30	240	24.0
BIO131	Introductory Biology	3	15	1	15	3	15	0	0	0	0	1	15	120	12.0
COM141	Communication and Computer Skills	3	15	1	15	3	15	1	15	1	15	1	15	150	15.0
ANS151	Introduction to Agriculture	3	15	1	15	3	15	1	15	0	0	1	15	135	13.5
AEC132	Farm Accounts and Introductory Agricultural Economics	3	15	1	15	0	0	1	15	1	15	1	15	105	10.5
MAT142	Biometry	3	15	1	15	0	0	1	15	0	0	2	15	105	10.5
ANS152	Introduction to Agricultural Botany	3	15	1	15	3	15	1	15	0	0	1	15	135	13.5
												TOTAL		1200	120

Second Year Courses

COURSE CODE	COURSE TITLE	CONTACT HOURS													CREDIT POINTS	
		Lectures		Tutorials		Laboratory		Seminars		Field Work		Assessments and Self Study		Total Notional Hours		
		Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk		No. of Wks
ANS210	Fundamentals of Animal Anatomy and Physiology	3	30	0	0	3	30	0	0	0	0	2	30	240	24.0	
CHEM221	Animal Biochemistry	3	15	3	15	1	15	0	0	0	0	1	15	120	12.0	
AEN231	Principles of Agro Climatology	3	15	2	15	0	0	0	0	1	5	0	0	90	9.0	
AEC241	Entrepreneurship and Innovation	3	15	2	15	0	0	1	15	1	15	1	15	120	12.0	
BIO251	Zoology	3	15	2	15	0	0	1	15	1	15	1	15	120	12.0	
AEN222	Farm Structures	3	15	0	0	3	15	0	0	2	15	1	15	135	13.5	
AEN232	Climate Change and Variability	3	15	2	15	0	0	1	15	2	15	1	15	135	13.5	
CSC242	Field Crop Production	3	15	0	0	3	15	9	0	3	15	1	15	150	15.-0	
AEC252	Farm management	3	15	1	15	0	0	1	15	15	0	0	15	90	9.0	
ANS262	Field attachment I	Conducted during holiday: 40 hours/week x 6 weeks														
														TOTAL	1200	120

Third Year Courses

COURSE CODE	COURSE TITLE	CONTACT HOURS													CREDIT POINTS
		Lectures		Tutorials		Laboratory		Seminars		Field Work		Assessments and Self Study		Total Notional Hours	
		Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks		
ANS311	Fundamentals of Aquaculture	3	15	2	15	2	15	0	0	1	15	1	15	135	13.5
ANS321	Principles of Animal Nutrition	3	15	2	15	2	15	0	0	1	15	1	15	135	13.5
ANS331	Animal Genetics, Sheep, Goat and Rabbit Production	3	15	2	15	0	0	0	0	0	0	1	15	90	9.0
ANS341	Applied Experimental Design and Analysis for Agricultural Research	3	15	2	15	0	0	1	15	1	15	1	15	120	12.0
ANS351	Research	3	15	1	15	0	0	0	0	0	0	1	15	75	7.5
ANS361	Field Attachment II	Conducted during holiday: 40 hours/week x 6 weeks													
ANS312	Animal Health	3	15	2	15	2	15	1	15	1	15	1	15	150	15.0
ANS322	Poultry Production	3	15	1	15	1	15	1	15	2	15	1	15	135	13.5
ANS332	Animal Growth and Development	3	15	1	15	2	15	0	0	1	15	1	15	90	9.0
ANS342	Applied Animal Nutrition	3	15	2	15	2	15	0	0	1	15	1	15	135	13.5
ANS352	Pig Production	3	15	2	15	1	15	1	15	1	15	1	15	135	13.5
												TOTAL		1200	120

Fourth Year Courses

COURSE CODE	COURSE TITLE	CONTACT HOURS													CREDIT POINTS	
		Lectures		Tutorials		Laboratory		Seminars		Field Work		Assessments and Self Study		Total Hours		
		Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks	Hrs/ Wk	No. of Wks			
ANS411	Animal Breeding	3	15	2	15	0	0	1	15	2	15	1	15	135	13.5	
ANS421	Pasture Management and Forage Production	3	15	0	0	3	15	0	0	2	15	1	15	135	13.5	
ANS431	Beef Production	3	15	0	0	3	15	0	0	2	15	1	15	135	13.5	
ANS441	Aqua production and Management	3	15	0	0	3	15	0	0	2	15	1	15	135	13.5	
ANS451	Applied Animal Production	3	15	0	0	3	15	0	0	2	15	1	15	135	13.5	
AEC412	Agricultural Extension and Rural Sociology	3	15	2	15	0	0	1	15	2	15	1	15	135	13.5	
ANS422	Range Management	3	15	0	0	1	15	0	0	3	15	1	15	120	12.0	
ANS432	Dairy Production	3	15	0	0	3	15	0	0	2	15	1	15	135	13.5	
ANS442	By-Products	3	15	0	0	2	15	0	0	3	15	1	15	135	13.5	
ANS452	Research Project	Conducted during holiday: 40 hours/week x 6 weeks														
														TOTAL	1200	120

8.0 ASSESSMENTS

Assessment of students is in accordance with the University regulations. Students will be assessed through written continuous assessments and a comprehensive final examination all of which accounts for a total of 100% of the coursework. The continuous assessment ratings differ from course to course, however, generally, it includes written assignments, reports, quizzes, tests and practicals whose weighting varies depending on the course and this detail is stipulated under each respective course. The continuous assessment accounts for 40% of the marks. The written final examination accounts for 60% of the total marks. Additionally, students are scheduled to participate in an industrial attachment at an institution dealing with their chosen area of specialization. Lastly, students also are required to undertake a supervised research project in their fourth year. At the end of the research project students present their research findings at an oral defence followed by submission of a dissertation that is deposited with the university library.

9.0 ACADEMIC STAFF

9.1 Staff qualifications

The academic staff enumerated shall possess the requisite qualifications to teach the courses assigned. The School has adequate human resource required for teach this programme, with a minimum of Master's degree for both full time and part time lecturers.

9.2 Staff development programme

The Harvest University has a staff development policy which aims at articulating and harmonizing a comprehensive staff development policy that will guide recruitment, retention, and training of staff for increased efficiency and performance on the staff at all levels of University establishment.

9.3 Staff workloads

Each lecturer teaches between three to four half-courses per Semester. This translates into three to four hours of lectures each week. . In addition, lecturers are expected to undertake documented research and publish at least one peer reviewed journal/ conference paper or contribute a chapter in a book per calendar year. Furthermore, members of staff are also

expected to carry out administrative duties as assigned to them by the university. Finally, each academic staff is expected to be involved in consultancy work and public service.

10.0 FACILITIES FOR PROGRAMME DELIVERY

The School of Agricultural Sciences has sufficient lecture rooms for use during full time and residential classes held at the University premises. Additionally, the University has a library and a 3-hectare farmland in Mwembeshi area of Mumbwa district which will be used for demonstration, teaching, research, training and commercial production. In addition, the university has laboratory use arrangement with the University of Zambia, School of Agricultural Sciences, under a Memorandum of Understanding (MoU) signed in 2019 and runs for a five (5)-year period subject to renewal.

11.0 TEACHING AND LEARNING SUPPORT

The university has two modes of learning, namely: full-time and part-time. The parttime students will be required to undergo two weeks' residential classes during which period there will be interactions with the Lecturers and with fellow students. The students will also be provided with Modules for each course to aid learning and comprehension. Additional guidance will be provided through tutorial and laboratory classes. Students will also be required to undergo field attachments of not less than 3 months in the third year of study. The students will further be required to carry out a research project in their fourth year under the supervision of an academic member of staff. Full-time students will also use the same facilities for learning.

The University has a wide range of ICT support to aid in the execution of teaching and learning responsibilities. This is facilitated by availability of a reliable internet connectivity both by cable and wireless. The University Library has access to e-learning resources such as e-books, e-journals, digital libraries and online databases.

12.0 PROGRAMME GOVERNING REGULATIONS

12.1 Undergraduate Entrance Requirements, Curricula and Degree Regulations

- (a) Candidates must be in possession of a full School Certificate with Credits or better in five O -Levels including English, Mathematics, Science (Biology, Chemistry, Physics, Agriculture science, Food & Nutrition) and any other two relevant subjects.

Any relevant college certificate will be an added advantage.

- (b) A credit passes at diploma level or equivalent from any tertiary institutions recognized by the University shall qualify one for exemption from first year courses.
- (c) Any other qualification at certificate level, shall be evaluated, determined and approved by the Senate.

12.2 Examinations

All the examinations and assessments for the programme shall be conducted in accordance with the University rules and regulations. Examinations account for 60% of student's total course grade. All the examinations for the programme shall be conducted in accordance with the University rules and regulations and these will be conducted at the end of each semester To be eligible to sit for the final examination, only students who would have attended 80% of class lectures will be permitted to do so.

12.3 Progression Criteria

- I) To proceed from one academic year to the other, a candidate must pass all the courses taken during each academic year. However, the Board of Examiners may permit a candidate who has failed in no more than two half-courses or one full course to proceed and repeat the failed course(s) along with the full load for the subsequent year; except where the failed course is a pre-requisite to a higher course in which case the candidate shall not be allowed to take a higher course for that year. Additional rules governing other aspects of progression will be provided by senate.

The pass mark for all courses is 50%.

- ii) The minimum number of courses to be taken by a student per semester shall be four while the maximum shall be five. Therefore, the total minimum and expected maximum number of courses per programme shall be 32 and 40, respectively.
- iii) The minimum period within which to complete the programme shall be four (4) years while the maximum shall be six (6) years.

12.4 Degree Regulations

Award of degrees at the Harvest University is guided by its regulations. To qualify for the award of a Bachelor of Science degree in the School of Agricultural Sciences, a student must have fulfilled all the requirements for admission and subsequently

completed the course of study to the satisfaction of the Boards of Examiners of the School. Senate approval is the final authority for the degree award.

A student must have completed four years of undergraduate studies and taken a minimum total of 32 courses subject to exemptions granted. The student must have also satisfactorily completed a 3-month field attachment in the fourth year and submitted a final year research project.

12.5 Degree Classification

The University First Degree classification system uses all 16 courses at 3rd (8 courses) and 4th (8 courses) year levels. The classification is based on the point system as follows:

Score	Grade	Points (Full Course)	Points (Half Course)
85-100	A+	6.0	3.0
75-84	A	5.0	2.5
65-74	B+	4.0	2.0
60-64	B	3.0	1.5
55-59	C+	2.0	1.0
50-54	C	1.0	0.5

Using the Point System stated above and using only the half-course rating of 0.5 to 3 points, the Degrees obtained at Harvest University will be classified as follows:

- Distinction : 40 points and above
- Merit : 32 – 39.5 points
- Credit : 24 – 31.5 points
- Pass : 8 – 23.5 points

Example of a Degree classification using the point system above:

Student X completed the following 16 courses at 3rd and 4th Year levels

- DS 16 B DS 31 B DS 32 B DS 33 A
- DS 35 C+ DS 36 B DS 39 B DS 45 B+
- DS 37 B DS 40 B DS 41 B+ DS 50 B
- DS 42???
- DS 47 B+ DS 49 B+ DS 46 B

Using the **0.5 to 3 points system** the above 3rd and 4th year 16 grades add up to a total of 26.5 points which is a **CREDIT**. Note that at HU a pass begins at 50% as shown in the grading system in table (a) above

Grading system for Assignments, Tests and Examinations

Letter Grade	Percentage Grade	Pass/Fail Grade
A+	Above 86%	Distinction
A	75 – 85%	Distinction
B+	70 – 74%	Merit
B	65 – 69%	Credit
C+	60 – 64%	Pass
C	50 – 59%	Bare Pass
D+	45 – 49%	Bare Fail
D	44% – and Below	Fail
IN	-	Incomplete
NE	-	Not Examined

METHOD OF CURRICULUM DELIVERY

- Conventional method of delivery

14.0 LINKAGES WITH EXTERNAL INSTITUTIONS

Harvest University shall accept application of affiliation from academic institutions such as universities and colleges; provided that such institution(s) meets the university's criteria of affiliation. A Memorandum of Agreement shall be entered into and signed by two parties, namely, The Harvest University and the university/college concerned in which areas of collaboration shall be spelt out

At the moment Harvest University is collaborating with University of Zambia on the in Lusaka in different areas of academic interest. The university is also collaborating with various scientific research institutions in Zambia.

DESCRIPTION OF FIRST YEAR COURSES

SEMESTER 1		YEAR ONE	SEMESTER II	
MAT111	Introductory Mathematics		ANS112	Introduction to Agriculture
PHY121	Introductory Physics		AEC122	Farm Accounts and Introduction to Agricultural Economics
CHE131	Introductory Chemistry		ANS132	Introduction to Agricultural Botany
BIO 141	Introductory Biology		BIO142	Zoology
COM115	Communication and Computer Skills		MAT152	Biometry

COURSE TITLE : **INTRODUCTORY MATHEMATICS**
COURSE CODE : **MAT 110**
PRE-REQUISITES : **NONE**

Aim

The course is designed to provide foundation Mathematics to all students in the University which requires application of mathematical knowledge in agricultural sciences.

Learning Outcomes

Upon successful completion of this course, students should be able to:

1. Describe different SI Units.
2. Calculate the perimeter, area, volume techniques to real life situations.
3. Describe set operations, set of numbers, relations, functions, simplify expressions and solve equations, and Inequalities involving functions.
4. Demonstrate knowledge of limits, differentiation and their applications.
5. Apply laws of Exponentials and Logarithms to solve equations.
6. Apply correctly the types of variations i.e. direct, indirect (inverse), joint variations and.
7. Evaluate integrals, definite and indefinite integrals.

Course outline

1. S. I. Units

- 1.1. Basic S.I.U units
- 1.2. Names and symbols
- 1.3. Essential features of the system
- 1.4. Conversion factors
- 1.5. Decimal multiples
- 1.6. Some useful derived S. I Units with special names.

2. Mensuration

- 2.1. Length, area and volumes

- 2.2. Numerical methods for calculating areas and volume of irregular shapes; sphere, circle, cylinder, prism and pyramid. Trapezium rule.

3. Sets and Counting

- 3.1. Set theory; set notation; universal sets and subsets; empty sets; cardinal number
- 3.2. Venn diagrams; operation on sets; union, intersection, complement and differences, application of set theory.
- 3.3. Counting; permutation, combination.

4. Functions

- 4.1. Relations, Domain, range, composition of Function, Even and Odd functions, Graphs of functions

5. Numbers

- 5.1. Order of operations
- 5.2. Indices
- 5.3. Scientific notation
- 5.4. Fractions.
- 5.5. Decimals
- 5.6. Percentage

6. Algebra expressions

- 6.1. Simplifying
- 6.2. expanding
- 6.3. factorizing

7. Rearranging equations

- 7.1. Cartesian Plane
- 7.2. Linear equations
- 7.3. Solving equations
- 7.4. Solving simultaneous equations

8. Geometry

9. Quadratics

10. Vectors

11. Exponentials

12. Logarithms

13. Logarithms

14. Measurement

15. Calculus

- 15.1. Limits of functions
- 15.2. Differential calculus. Gradient of curve, velocity, the derivatives, some properties of the derivative and rules for differentiations.
- 15.3. The second derivative, derivatives of exponential logarithms and trigonometric functions, applications of the derivation.
- 15.4. Integral calculus: integration, integrals and their properties. Definite integrals and their properties

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours tutorials

Assessment

Two assignments/Quizzes	10%
Two tests	30%
Continuous Assessment	40 %
Final Examination	60 %

Prescribed Readings

1. Backhouse, J. K., Houldsworth, S. T. P., Horril, P. J. F., Wood, J. R., and Cooper, B.E.D. (1991). *Essential Pure Mathematics*. London: Longman group Ltd.
ISBN: 0-582-06658-1
2. Chandler, L and Bostock, L. (2000). Core Mathematics for Advanced level.
Cambridge: Nelson Theones

Recommended Readings

1. Kaufman, R. N. et al., (2011). *College Algebra and Trigonometry*. (7th Ed.). Brooks/Cole Cengage Learning. ISBN 1-439-04939-6.
2. Larson, R. (2013). *College Algebra and Calculus*. (2nd Ed.). Brooks/Cole Cengage learning. ISBN: 1-133-10518-3.

COURSE TITLE : **INTRODUCTORY CHEMISTRY**
COURSE CODE : **CHE 120**
PRE-REQUISITES : **NONE**

Aim

The aim of this course is to set a strong foundation for students studying life science courses so as to apply its principles in their field of study.

Learning Outcomes

Upon successful completion of this course, the students should be able to:

1. Perform mathematical manipulations with proper attention to units and significant figures;
2. Calculate the amounts of chemicals involved in reactions based on balanced chemical equations and the mole concept;
3. Identify the outcome of the various types of chemical reactions including acid-base and precipitation reactions;
4. Carry out calculations involving pH and pKa values of buffer systems;
5. Recognize oxidation-reduction reactions using the concept of oxidation numbers and balance oxidation-reduction reactions;
6. Apply the kinetic theory to ideal and real gases;
7. Describe the atomic structure and write electronic configurations;
8. Explain the type of bonding and relate to physical properties explain the factors that affect the rates of chemical reactions;
9. Perform various calculations on solution chemistry;
10. Define solute, solution, solvent and colligative properties; and
11. Describe colloidal systems.

Course outline

1. Introduction

1.1. Early history of chemistry

1.1.1 Greek Theory and Roman practice

1.1.2 Through the Middle ages to Alchemy

1.1.3 Alchemy

1.1.4 Two Centuries of Transition: 1600-1800

1.1.5 Common Gases and the Atmosphere

1.1.6 The Chemical Concepts of Lavoisier

2. Measurement in chemistry

2.1 Measurement: The International System of Units

2.2 Error in Measurements

3. Mathematical Tools for Chemistry

3.1 Basic Mathematical Tools for Chemistry

3.2 Use of Algebra in Chemistry

4. Atoms and Molecules

4.1 The Atomic Theory of Matter: John Dalton

4.2 The Atomic Theory of Matter: Modern Theory

4.3 The Chemical Nature of Atoms

4.4 The Periodic Chart of Elements: Empirical Chart

4.5 Principles of Chemical Nomenclature

5. Molar Stoichiometry

5.1 Mole: Amount of Substance

5.2 Moles of Molecules

5.3 Moles of Reaction

5.4 Moles of Solutes

5.5 Reactions in Solution

6. Gases: The Empirical Gas Laws

6.1 Empirical Gas Laws: Pressure and Boyle's Law

6.2 Empirical Gas Laws: Temperature and Charles' Law

- 6.3 Empirical Gas Laws: Volumes of Gases
- 6.4 Empirical Gas Laws: Partial Pressures of Gases
- 6.5 Empirical Gas Laws: Vapor Pressures
- 7. **Gases: The Ideal Gas Law**
 - 7.1 Introduction to the Ideal Gas Law
 - 7.2 Universal Gas Constant and Ideal Gas Law Calculations
 - 7.3 The Ideal Gas Law: Molar Volume of an Ideal Gas
 - 7.4 Applications of the Ideal Gas Law
- 8. **Kinetic-Molecular Theory and the Ideal Gas Law**
 - 8.1 Introduction to the Kinetic-Molecular Theory of Gases
 - 8.2 Explanation of Gas Pressure
 - 8.3 Explanation of Gas Temperature
 - 8.4 Explanation of Partial Pressure
 - 8.5 Velocities of Molecules, Effusion, Diffusion
 - 8.6 Equations of State for Gases
- 9. **Heat versus Enthalpy**
 - 9.1 Thermodynamics: Early Concepts of Heat
 - 9.2 From Heat to Enthalpy: Thermometry
 - 9.3 From Heat to Enthalpy: Calorimetry
 - 9.4 Determining Enthalpies of Substances
- 10. Enthalpy Changes in Reactions
- 11. Chemical Equilibrium: A Dynamic Concept
 - 11.1 Chemical Equilibrium is a Dynamic State
 - 11.2 The Law of Mass Action
 - 11.3 Chemical Activities of Substances
- 12. **Chemical Equilibrium: Equilibrium Constants**
 - 12.1 Equilibrium Constants: The Principle of Le Chatelier
 - 12.2 Equilibrium Constants: Explain the Principle of Le Chatelier
 - 12.3 Form, Nominal Units, and Values of Equilibrium Constants
 - 12.4 The Different Types of Equilibrium Constants
- 13. **Chemical Equilibrium: Gas-Phase Equilibria**

- 13.1 Simple Gas-Phase Equilibria
- 13.2 Gas-Phase Equilibria: Effects of Added Reactants or Products
- 13.3 Gas-Phase Equilibria: Effects of Pressure and Temperature
- 13.4 Mixed-Phase Equilibria
- 14. Acids and Bases: Aqueous Terms and Concepts**
 - 14.1 Acids and Bases: Aqueous Terms and Concepts
 - 14.2 Stoichiometry of Acid-Base Reactions
 - 14.3 Ionization Constants of Acids and Bases

- 15. Acids and Bases: Aqueous Reactions**
 - 15.1 Ionization Constants Are Measures of Intrinsic Strength of Acids and Bases
 - 15.2 pH is the Measure of Solution Acidity
- 16. Acids and Bases: Acidities of Aqueous Solutions**
 - 16.1 Acidity of Solutions of Strong Acids
 - 16.2 Acidity of Solutions of Strong Bases
 - 16.3 Acidity of Solutions of Weak Acids
 - 16.4 Acidity of Solutions of Weak Bases
 - 16.5 Acidity of Solutions of Amphoteric Substances
- 17. Acids and Bases: Buffer Solutions and Titrations**
 - 17.1 Acidity of Solutions of Acid-Base Buffers
 - 17.2 Response to Stress of Aqueous Buffers
 - 17.3 Preparation of Aqueous Buffer Solutions
 - 17.4 Acid base Titration

- 18. Solutions and Solubility: Terms and Concepts**
 - 18.1 Dissolution, Equilibrium, and Precipitation
 - 18.2 Henry 's Law and the Solubility of Gases
 - 18.3 Solubility of Ionic Solids in Water

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours tutorials

Assessment

1. Continuous Assessment	40 %
1.1 Assignments	10%
1.2 Practicals	30%
2. Final Examination	60 %

Prescribed Readings

1. Steven, S. Z., and Susan, A.Z. (2010). *Chemistry*. (8th Ed.). Brooks / Cole, Cengage
ISBN-10: 0495829927
2. Christian, G. D. (2004). *Analytical Chemistry*. (6th Ed.). John Wiley and Sons, Inc., New York. ISBN: 978-81-265-1113-6
3. Atkins, P., and Julio de Paula. (2009). *Physical Chemistry*: (9th Ed.). Vol. 1: Thermodynamics and Kinetics; W. H.Freeman; Ninth Edition,.
4. Graham, S. T.W. (2008).*Organic Chemistry*. (9th Ed.). New York: John Wiley and Sons. ISBN 10: 0471684961 ISBN 13: 9780471684961

Recommended Readings

1. Engel, T., and Reid, P. (2010).*Physical Chemistry*, Prentice hall, ISBN 10-0-32164305-4
2. Hughey, J. E and Harper, R. (2008). *Inorganic Chemistry*. New York. ISBN-8177581309, 978-8177581300
3. Alan, G. S. (2012). *Inorganic Chemistry*. (4th Ed.). Longman: Singapore Publisher ISBN-10:0273742752 | ISBN-13: 978-0273742753

COURSE TITLE : INTRODUCTORY BIOLOGY

COURSE CODE : BIO 131

PRE-REQUISITES : NONE

Aim

The aim of the course is to provide an introduction into the study of general biology, starting from basic scientific concepts and processing to chemistry, physics and the natural laws that govern life and all living things.

Learning Outcomes

Upon successful completion of this course, the students should be able to:

1. State the ecological issues that affect our everyday lives;
2. Describe theories of genetics to help in solving and applying genetics in day to day life and technology
3. Describe the asexual and sexual reproduction in flowering plants and in mammals

Course outline

1. The scientific method. Hypothesis and theory
2. **Meaning of biology**
 - 2.1 The nature of living mater
 - 2.2 Molecules – simple and complex
3. **Bonding**
4. **Life**
 - 4.1 Living matter
 - 4.2 Levels of organization
 - 4.3 Biochemistry
 - 4.4 The cell – animal and plant
 - 4.5 Cell communication
 - 4.6 Membranes and their importance

5. **Energy**

5.1 Types of energy

5.2 Thermodynamics

5.3 Redox reactions

5.4 ADP/ATP

5.5 Enzymes

5.6 Internal respiration

5.7 Photosynthesis

6. **Genetics**

6.1 DNA and its replication

6.2 Chromosomes

6.3 Mitosis and Meiosis

6.4 Egg and sperm formation

6.5 Mendel and his pea

6.6 Multiple alleles

6.7 Genes and environment 7. **Evolution**

7.1 Darwin and his theories

7.2 Natural selection

7.3 Evidence for evolution

7.4 Speciation

8. **The Diversity of Life**

8.1 Viruses

8.2 Bacteria

8.3 Archaea

8.4 Eukaryotes

8.5 Protista

8.6 Fungi

9. **Plants**

9.1 Plant structure

9.2 Plant physiology

9.3 Plant cell types

- 9.4 Primary and secondary growth
- 9.5 Plant reproduction
- 9.6 Animal Anatomy & Physiology
- 9.7 Tissue types
- 9.8 Organ systems
- 9.9 CNS & PNS
- 9.10 The brain
- 9.11 Endocrine system
- 9.12 Immune system
- 9.13 Blood, respiration, digestion
- 9.14 Renal system
- 9.15 Human reproduction

10. Ecology

- 10.1 Population size and dynamics
- 10.2 Biodiversity
- 10.3 Competition
- 10.4 Predator/Prey interactions
- 10.5 Symbiosis

Practicals

1. Morphology of flowering plants – root, stem and leaf and their modifications.
2. Inflorescence, flower and fruits.
3. Cell, tissues & cell division.
4. Internal structure of root, stem and leaf.
5. Study of specimens and slides.
6. Description of plants - Brassicaceae, Fabaceae and Poaceae.

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours tutorial

Assessment

1. Continuous Assessment	40 %
1.1 Continuous assignments	10%
1.2 Practicals	30%
2. Final Examination	60 %

Prescribed Readings

1. Johnson, G. and Losos, J. (2008). *The Living World*. (5thEd.). New York: Mc Graw Hill and Company.
2. Purves, W.K., Orians, G.K, and Heller, H.C. (1995). “Characteristics of Living Organisms.” *In Life: The science of Biology*. (4th Ed.). Sunderland, MA: Sinauer Associates.
3. Starr, E and Starr. (2015). *Biology: Today and Tomorrow*. (5th Ed.).

Recommended Readings

1. Phillips, W.D. and Chilton, T.J. (1994). *A Level Biology*. London: Oxford University Press.
2. Taylor, D.J., Green, N.P.O. and Stout, G.W. (1997). *Biological Sciences*. (8th Ed.). London: Cambridge University Press.

1.4 COURSE NAME : COMMUNICATION AND STUDY SKILLS

COURSE CODE : COM 141

PRE-REQUISITES : NONE

Aim

During the course of your studies as a university student, you will have to communicate in various ways and with different categories of people. It is important to emphasize that your ability to communicate effectively is quite essential to your academic attainment, social acceptability, physical and emotional well-being, and ultimately your chances for securing employment. Therefore, this course is designed to enable you master the art of communication and computer Skills.

Learning Outcomes

By the end of this course, students should be able to:

- 1.1 Define communication
- 1.2 Describe the main elements of communication
- 1.3 Identify types and models of communication
- 1.4 State the barriers to effective communication
- 1.5 Apply effective listening strategies to a given situation.
- 1.6 Acquire potential skills for job search interviews
- 1.7 Write an assignment of essay type
- 1.8 Acknowledge different sources of information
- 1.9 Avoid the risks of plagiarism in an academic setting

Course Content

1.0 Understanding Communication

- 1.1 The Communication Process
- 1.2 Meaning of Communication
- 1.3 Objective/Purpose of communication
- 1.4 Essential Elements of Communication

2.0 Forms of Communication

- 2.1 Written communication
- 2.2 Oral Communication
- 2.3 Non-verbal Communication

2.4 Visual Communication

3.0 Directions of communication

3.1 Downward communication

3.2 Upward communication

3.3 Horizontal communication

3.4 Diagonal communication

3. Theories and Types Communication

4.1 Theories of communication

4.1.1 Linear Models of Communication

4.1.2 Interactive Model

4.1.3 Transactional Model

4.2 Types of Communication

4.2.1 Interpersonal Communication

4.2.2 Intrapersonal Communication

4.2.3 Intergroup Communication

4.2.4 Mass Communication

5. **Barriers of Communication**

5.1 Physical Barriers

5.2 Semantic Barriers

5.3 Psychosocial Barriers

6. **Principles of Effective Communication**

6.1 Reading and Study Skills

6.1.1 The Meaning and Nature of Reading

6.1.2 Different types of Reading

6.1.3 Studying skills

6.2 Listening skills

6.2.1 Meaning of listening

6.2.2 Listening strategies

6.2.3 Types of listening

- 6.2.4 Barriers to effective listening
- 6.3 Speaking skills
 - 6.3.1 Strategies for developing speaking skills
 - 6.3.2 Oral presentation
 - 6.3.3 Preparation of oral presentation
 - 6.3.4 Methods of oral presentation
 - 6.3.5 Essential qualities of a good presenter
 - 6.3.6 Job Search Interview skills
- 6.4 Writing skills
 - 6.4.1 Letter Writing
 - 6.4.2 Formal and Informal Letters
 - 6.4.3 Curriculum Vitae
- 7. **Assignment essay writing**
 - 7.1 Five Steps to Successful Writing of an Essay
 - 7.2 Methods of Essay Development
- 8. **Note-Taking during lectures**
 - 8.1 Taking lecture notes
 - 8.2 Strategies
- 9. **Examination skills**
 - 9.1 What is an examination skill?
 - 9.2 Examination rubrics
 - 9.3 Preparation strategies to pass an examination
- 10. **Academic writing skills**
 - 10.1 Academic Writing Skills
 - 10.2 Referencing Skills
 - 10.3 Referencing and Citation
 - 10.4 Quotations and Block Quotations
 - 10.5 The Harvest University Referencing Style
 - 10.6 Order and Style of Citation Details
- Understanding plagiarism**
 - 10.7 What is plagiarism?
 - 10.8 Ways of plagiarism

- 11. Concept of Information Technology**
 - 11.1 Hardware
 - 11.2 Software
 - 11.3 Information technology
- 12. Using the Computer and Managing files**
 - 12.1 Basic knowledge of a windows environment
 - 12.2 Dialog boxes and the Control Panel
 - 12.3 Files and filenames
 - 12.4 Managing flush disks, drives and files, My computer and Windows Explorer
 - 12.5 Viruses
 - 12.5.1** Types of Viruses
 - 12.5.2** Control of Viruses
- 13. Word Processing: Microsoft Word**
 - 13.1 Loading the program
 - 13.2 Creating, saving and closing a document, Activating/recalling a document
 - 13.3 Editing Functions, Document layout and formatting
 - 13.4 Tables and Graphics
 - 13.5 Spelling and Grammar
 - 13.6 Printing
- 14. Spreadsheets: Microsoft Excel**
 - 14.1 Introduction
 - 14.2 Basic workbook and worksheet skills
 - 14.3 Formulas
 - 14.4 Charts
 - 14.5 Editing and other functions
 - 14.6 Document setup and Printing
- 15. Database: Microsoft Access**
 - 15.1 Introduction

- 15.2 Building a basic database
- 15.3 Editing data and records
- 15.4 Retrieving information and creating Reports
- 16. Presentation: Basic PowerPoint Skills**
- 16.1 Basic Skills
- 16.2 Creating, Saving and Closing a Presentation
- 16.3 PowerPoint masters, adding effects before producing a slide show
- 16.4 Printing a presentation
- 17. The Internet Guide**
- 17.1 General
- 17.2 Connecting to the Internet
- 17.3 Exploring the World Wide Web (www)
- 17.4 Surfing a website and Searching the internet
- 17.5 Electronic mail (e-mail) and E-Commerce

3 lecture hours per week

1 hour tutorial

Assessment	40%
2 Assignments	10%
2 Tests	30%
Examination	60%

Prescribed Readings

1. Steinberg, S. (2007). *An Introduction to Communication Studies*. Cape Town: Juta.
2. American Psychological Association. (2010). *Publication manual of the American Psychological Association*. (6th Ed.). Washington, DC: Author. [Massey Library link]
3. Mahelo, E.B. (2015). *Fundamentals Communication Skills*. GG Publisher Mwanza, Tanzania.
4. Rajaraman, V., and Adabala, N. (2015). *Fundamentals of Computers*. PHI

Recommended Readings

1. Giles, Howard, ed. (2012). *The handbook of intergroup communication*. New York: Routledge.
2. Griffin, E. (2009). *A first look at communication theory*. McGraw Hill: New York, NY. ISBN 978-0-07-338502-0
3. Pearce, K.J. (2009). *Media and Mass Communication Theories*. In *Encyclopedia of Communication Theory*. SAGE Publications. pp. 624-628.
4. Antos, G. (2011). *Handbook of interpersonal communication*. The Hague, The Netherlands: Mouton DeGruyter
5. Brownell, J. (2009). *Listening: Attitudes, principles, and skills*. Boston, MA: Pearson
6. Kneen, J. (2011). *Essential skills: Essential speaking and listening skills*. New York, NY: Oxford University Press
7. Alvarez, P. Jr. (1994). *Effective Note-Taking*. The CalREN Project, University of California, Berkeley. Retrieved July 11, 2017, from <http://slc.berkeley.edu/studyandsuccess-strategies>
8. Gurvinder, S., Rachhpal S., and Saluja, K. K. (2003). *Fundamentals of Computer Programming and Information Technology*. Kalyani Publishers.
9. Harshawardhan, P. Bal. (2003). *Perl Programming for Bioinformatics*. Tata McGraw- Hill Education.
10. Keyton, J. (2010). *Case studies for organizational communication: Understanding communication processes*. New York, NY: Oxford University Press.
11. The Open University of Tanzania (OUT). (2016). *Prospectus 201/2016*. OUT: Dar es Salaam.
12. Cottrell, S. (2008). *The Study Skills Handbook*. Basingstoke: Palgrave Macmillan.
13. Kumar, A. (2015). *Computer Basics with Office Automation*. IK International Publishing House Pvt Ltd.

.5 COURSE TITLE : INTRODUCTION TO AGRICULTURE

COURSE CODE : ANS 151

PRE-REQUISITES : NONE

Aim

This course is specifically designed to introduce first year students to the world of agriculture. The course deals with career opportunities in agriculture and introduces students to the areas of animal science, agronomy, soil science, horticulture, natural resources and other fields related to animal production

Learning outcomes

Upon completion of this course, students should be able to:

1. Define agriculture
2. Explain the historical geneses of agriculture
3. Explain the scope of agriculture
4. State the importance of agriculture,
5. Describe the branches of agriculture,
6. Acquire fundamental concepts and principles of land resources focussing on development and production of in a sustainable manner appropriate in Zambia and abroad;
7. Demonstrate basic competences in the management of land resources and food production;
8. Acquire basic knowledge, skills and attitudes to manage a sustainable food production enterprise;
9. Explain agricultural production systems,

Course content

1. Introduction to Agricultural Science

- 1.1 Definition of agriculture
- 1.2 Historical genesis of agriculture
- 1.3 Farming Systems of agriculture
 - 1.3.1 Integrated farming system and others
 - 1.3.2 Factors affecting farming systems
 - 1.3.3 Farming system components and their maintenance,

2. Good Agricultural Practices

- 2.1 Basic concepts of GAP
- 2.2 GAP related to Soil
- 2.3 GAP related to water
- 2.4 GAP related to the environment
- 2.5 Sustainable Agriculture.
 - 2.3.1 Problems and its impact on agriculture,
 - 2.3.2 Indicators of sustainability,
 - 2.3.3 Adaptation and mitigation,
 - 2.3.4 Conservation agriculture strategies in agriculture

3. Agricultural techniques

- 3.1 Dry farming
- 3.2 Precision farming
- 3.3 Organic farming

4. Agricultural Pests and diseases

- 4.1 Classification of Pests on the basis of economic threshold
- 4.2 Brief Description of the Important Pests of Crops
- 4.3 Effects of Pests on Crop Plants
- 4.4 Insect Pest Control
- 4.5 Plant Diseases
- 4.6 Measures of Controlling Plant Diseases

5. Weed control

- 5.1 Principles of weed control
- 5.2 Cultural weed management systems
- 5.3 Biological methods of weed control
- 5.4 Chemical methods of weed control
- 5.5 Preventive methods of weed control
- 5.6 Integrated weed management systems

6. Crop Improvement

- 6.1 Mendel's Work in Genetics
- 6.2 Mendelian law
- 6.3 Crop Improvement
- 6.4 Objectives of crop improvement
- 6.5 Methods of crop improvement
- 6.6 Production of Hybrid Seed

Assessment

- | | |
|---------------------------|-----|
| 1. Continuous assignments | 40% |
| 2. Final examination | 60% |

Recommended Literature

1. Chandrasekaran B, Annaduri K, Somasundaram E (2010). A Textbook of Agronomy. ISBN13:978-8122427431, ISBN-10:812242743X
2. Reddy T.Y., Reddi G.H.S (2008). Principles of Agronomy. ISBN: 978-81-2726302-7
3. Singh S.S., Gupta P. and Gupta A.K. Handbook of Agricultural Science.

Recommended Readings

1. Singh S.S. Principles & Practices of Agronomy. 5. www.hasanuzzaman.webs.com
2. Panda, S.C. (2004). Cropping Systems and Farming Systems, Agrobios (India), Jodhpur.

COURSE TITLE : **FARM ACCOUNTS AND INTRODUCTORY
& AGRICULTURAL ECONOMICS**

COURSE CODE : **AEC 132**

PRE-REQUISITES : **NONE**

A. FARM ACCOUNTS (HALF COURSE)

Aim

To equip students with skills to prepare and interpret farm accounting information with the view to assess the financial performance of the farm business.

Learning Outcomes

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

1. Demonstrate understanding of the importance of keeping farm records
2. Describe the importance of bank accounts to a business entity
3. Use cash analysis book, petty cash and inventories
4. Prepare financial reports in order to determine profitability and financial position of an enterprise.

Course Outline:

1.0 Preliminary Concepts

1.1 Value of keeping accounts

1.1.1 Definition of farm accounts

1.1.2 Advantages of a Financial Character

1.1.3 Advantages of Accounts and Records in Farm Management and Organization.

1.2 The Standard Procedure in Purchasing and Selling

1.2.1 Documents used

1.2.2 Recording of Sales

1.2.3 Receipts and Farm Outputs

1.2.4 Self-billed Invoice

1.3 Banking and Credit

1.3.1 Importance of Maintaining a Bank Account;

1.3.2 Types of bank accounts; Opening a Current Account;

1.3.3 Procedure for Making out Cheques

1.3.4 Types of Cheques

1.3.5 Parties to a Cheque

1.3.6 Crossed Cheque;

1.3.7 Dishonoured and Stopped Cheques;

1.3.8 Bank Charges;

1.3.9 Treatment of the Bank Statement and explanation of Standing Order,

1.3.10 Direct Debit,

1.3.11 Credit, and Interest Charges;

1.3.12 Types of Credit; Sources of Credit;

1.3.13 Capital Acquisition: Equity Sources;

1.3.14 Debt Sources;

1.3.15 Three Rs of Credit;

1.3.16 Rules for Borrowing;

1.3.17 Legal Considerations;

1.3.18 The Cost of Credit; Rate of Interest;

1.3.19 Borrowing from the Bank

2.0 Single-entry System

2.1 The Cash Analysis Book:

2.1.1 Principles and Layout:

2.1.2 Choice of Columns and Cross Checking;

2.1.3 Detailed Cash Analysis Book:

2.1.4 Procedure for dealing with Farm and Private Transactions, Contra Transactions, and Capital Assets;

2.1.5 Bank Reconciliation

2.2 The Petty Cash Book:

2.2.1 Principles, Layout, and Recording;

2.2.2 Managing Petty Cash on the Farm Float and Imprest

Systems **3.0 Double-entry System**

3.1 The Journal:

- 3.1.1 Principle of Debit and Credit;
- 3.1.2 Rationale for double entry;
- 3.1.3 Types of subsidiary books in the Journal

- 3.2 The Ledger

- 3.3 Trial balance: Unadjusted trial balance; Adjusted trial balance

- 4.0 Farm Accounts**

- 4.1 Annual Farm Inventory: Types of Farm Inventories; Valuation of Stock; Depreciation; Straight line and Diminishing Balance Methods; Depreciation Summaries.**

- 4.2 The Income Statement: Non-cash Receipts; Adjustments for Opening and Closing Sundry Debtor and Creditors; Different types of Profit; Compilation**

B. INTRODUCTORY AGRICULTURAL ECONOMICS (HALF COURSE)

Aim

The course is designed to provide basic Concepts of Agriculture Economics to students pursuing the undergraduate degree course in Animal Science and Production at Harvest University.

Learning Outcomes

Upon completion of this course the student will be able to apply the basic concepts of Agricultural Economics theory in optimizing livestock and Aquaculture production business.

The student should be able to

1. Describe different Microeconomics theories.
2. Demonstrate knowledge of the basic concepts of production economics
3. Apply the skills and knowledge of Agriculture economics acquired, in optimizing livestock and Aquaculture production.

5.0 Course Outline

5.1. Fundamentals of Microeconomics;

- 5.1.1 Definition of Agricultural Economics,
- 5.1.2 Scarcity Economic Theories, Demand and Supply theory, Price theory,

Elasticity of Production.

5.1.3 Resources (Factors of Production) Resource service, Fixed and Variable Resources, Dependent and Independent Variables

5.2. Basic Concepts of Production Economics

5.2.1 Production and Productivity, Production function, Technical Co- Efficiency, Economic Efficiency and Optimality,

5.2.2 Cost of Production, Slope of a line. Marginal Returns, Farm Entrepreneurship, Stages of production, Law of diminishing Returns; Constant marginal Returns, Increasing marginal Returns and decreasing marginal Returns,

5.2.3 Law of Marginal rate of returns, Opportunity Cost, Gross Margins, Economies of Scale,

Contact hours

3 hours per week

2 hours tutorials

Assessment	40%
2 Assignments	10%
2 Tests	30%
Examination	60%

Prescribed Reading

1. Marshal, P. (2010). *Mastering Bookkeeping*, (9th Ed.). How to Books Ltd, United Kingdom (ISBN: 978184524466)

Recommended Readings

1. Agromisa Foundation. (2006). Farm Accounting. Digigrafi, Netherlands (ISBN: 9085733944)
2. Sturrock, F. G. (1982). Farm Accounting and Management, 7ed. Pitman, London. ISBN: 0273017659

Prescribed Reading for Introductory Agriculture Economics

1. Introduction to Agriculture Economics' 7th Edition
John Penson Author, Oral Capps, Jr. Capps, C. Rosson , Richard Wood ward
ISBN – 13:978-0134602820
ISBN – 10:01346028X

Recommended Reading for Introductory Agriculture Economics

1. Agriculture Economics and Agribusiness
Gail Crammer
ISBN – 13:978-0471388470
ISBN – 10:0471388475
2. Principles of Agricultural Economics (Routledge)
Andrew Barkely
ISBN – 978-1138914100
ISBN – 10:1138914101
3. Financial Management I in Agriculture
Peter Barry
ISBN - 978-0135037591
ISBN – 10:013503759X

COURSE TITLE : **BIOMETRY**
COURSE CODE : **MAT 142**
PRE-REQUISITES : **INTRODUCTORY
MATHEMATICS**

Aim

This course introduces students to statistical concepts and nomenclature applied in data collection, analysis and interpretation. Students will be exposed to the fundamental statistical techniques in estimation, hypothesis testing and analysis of variance, giving them an advantage when analyzing their research projects.

Learning Outcomes

Upon successful completion of this course, the students should be able to:

1. Apply sampling methods to collect data, summarize, describe and interpret data using various graphical methods.
2. Find point estimates and confidence intervals for population means, proportions and variances.
3. Carry out hypothesis tests concerning population means, proportions and variances.
4. Fit a simple linear regression given data of a response variable and predictor factor
5. Apply correlation analysis to determine the strength of linear association between two random variables.
6. Describe different types of random variable and their distributions.
7. Find expectations of functions of random variables for both discrete and continuous random variables
8. Find marginal and conditional distributions given joint probability functions

Course outline

1. Simple statistical analysis
2. Data collection and analysis
3. Samples, tabulation, graphical representation, describing location, spread and skewness
4. Introductory probability and distribution theory.

5. Sampling distributions and the central limit theorem.
6. Statistical inference:
 - 6.1 Basic principles,
 - 6.2 Estimation and testing in the one- and two-sample cases (parametric and nonparametric).
7. Introduction to experimental design.
 - 7.1 One- way designs
 - 7.2 Two- way designs,
 - 7.3 Randomized blocks.
8. Multiple statistical analysis
9. Bivariate data sets
10. Curve fitting (linear and non-linear), growth curves.
11. Statistical inference in the simple regression case.
12. Categorical analysis
 - 12.1 Testing goodness of fit and contingency tables
 - 12.2 Multiple regression and correlation
 - 12.3 Fitting and testing of models.
 - 12.4 Residual analysis.
13. Computer literacy: Use of computer packages in data analysis and report writing.

Duration: 15 weeks

Contact Hours

3 hours lectures per week

1 hour tutorial

Assessment

Continuous Assessment	40 %
2 assignments	30%
1 Test	10%
Final Examination	60 %

Prescribed Readings

1. Mclave, J.T., Sincich, T. (2002). *Statistics*. (12th Ed.). Pearson, ISBN: 0-321-75693-0
2. Ross, S. (2005). *A first course in probability*. (7th Ed.). Prentice Hall ISBN: 0-137-463146

Recommended Readings

1. Moore, D. S, and McCabe, G. P. (2012). *Introduction to the practice of Statistics*. (5th Ed.). New York: W.H. Freeman and Company ISBN: 1429 274333
2. Bain, L. J., Engelhardt, M. (2000). *Introduction to Probability and Mathematical Statistics*. Duxbury Press. ISBN: 0534 985637

COURSE TITLE: INTRODUCTION TO AGRICULTURAL BOTANY

COURSE CODE: ANS 152

PRE-REQUISITES : INTRODUCTORY BIOLOGY

Aim

This course provides students an introduction to the classification, relationships, structure, and function of plants. It also covers reproduction and development of seed and non-seed plants, levels of organization, form and function of systems

Learning outcomes

Upon successful completion of this course, students should be able to:

- State the form, functions and processes of the plant;
 - Relate plant form to environment;
 - Explain the physiological processes within plants so that they can appreciate the diversity in plants and hence crops; and
 - Select crops to grow for different environments. **Course outline**
1. Hierarchical organization of plant life, from single cells to flowering plants: algae, fungi, bryophytes, pteridophytes, gymnosperms, angiosperms;
 2. Structure of plant cells, tissues, organs.
 3. Fine cell structures and their functions.
 4. Mitosis, meiosis, molecular basis of inheritance, protein synthesis.
 5. Root modification,
 6. Arrangement of tissues in monocotyledonous (monocot) and dicotyledonous (dicot) roots.
 7. Stem: modification of stems, arrangement of tissues in monocot and dicot stems.
 8. Leaf: simple, compound, venation, shapes, arrangement and modification of leaves; arrangement of tissues in monocot and dicot leaves.
 9. Reproduction in plants.
 10. Flower: parts, types, floral arrangements (inflorescence), and floral diagrams.
 11. Fruit and seed: structure, types of germination and dormancy.

12. Principles of classification including concepts of species, genus, family, order, division and kingdom, binomial system of nomenclature.

Practical

1. Identification of plants
2. Classification of plants

Duration: 15 weeks

Contact Hours

3 hours lectures per week

1 hour practical per week

Assessment

Continuous Assessment **40 %**

Test 10%

Practicals 20%

2 Assignments 10%

Final Examination **60 %**

Theory examination 40%

Practical examination 20%

Prescribed Readings

1. Raven, P. H., Evert, R. F., and Eichhorn, S. E. (2004). *Biology of Plants*. (7th Ed.). W.H. Freeman.
2. Hopkins, W. G. and Huner, N. P. A. (2004). *Introduction to Plant Physiology*. (3rd Ed.). John Wiley and Sons inc. ISBN: 0-471-38915-3
3. Graham, L. E., Graham, J. M., and Wilson, L. W. (2006). *Plant Biology*. Pearson/Prentice Hall.
4. Stern, K. R. (2004). *Introductory Plant Biology*. Abe books.

Recommended Readings

1. Brian, C. (2010). *Botany for Gardeners: An Introduction and Guide*. (3rd Ed.). Portland Oregon: Timber Press, pp 268. ISBN:10: 160469095X
2. De Candolle, A. (2006). *Origin of Cultivated Plants*. Glacier National Park, MT: Kessinger Publishing. ISBN: 978-1-4286-0946-4.
3. Judd, W. S., Campbell, C. S., Kellogg, E. A., Stevens, P. F., and Donoghue, M. J. (2002). *Plant Systematics: A Phylogenetic Approach*. Sunderland, MA: Sinauer Associates. ISBN: 0-87893-403-0.
4. Heywood, V. H., Brummitt, R. K., Culham, A and Seberg, O. (2007). *Flowering Plant Families of the World*. Canada: Firefly Books. ISBN: 1-55407-206-9.

Year Two

SEMESTER I		SEMESTER II	
ANS210	Fundamentals of Animal Anatomy and Physiology	ANS210	Fundamentals of Animal Anatomy and physiology
CHE221	Animal Biochemistry	AEN222	Farm structures
AEN231	Principles of Agro Climatology	AEN232	Climate Change and variability
AEC241	Entrepreneurship and Innovation	CSC242	Field Crop production
BIO251	Zoology	AEC252	Farm management
		ANS262	Field attachment I

**COURSE TITLE: FUNDAMENTALS OF ANIMAL ANATOMY AND
PHYSIOLOGY**

COURSE CODE : ANS 210

PRE-REQUISITES : INTRODUCTORY BIOLOGY

Aim

The aim of the course is to introduce students with the principles and basic facts of animal physiology and anatomy.

Objectives

Upon successful completion of this course, the students should be able to:

1. Define anatomical and physiological terms;
2. Identify gross anatomical parts of farm animals;
3. Differentiate the micro anatomy of the various parts of an animal;
4. Relate the different anatomical parts to the functions they perform;
5. Develop knowledge about the functions of organs and tissues in the human body 6. State how the parts of the body are linked into a functioning whole; 7. Explain the principles of homeostasis and the methods used by the body; and
8. Apply practical knowledge of physiological techniques.

Course outline

1. **Introduction to Anatomy**
 - 1.1. Introduction to different livestock species
 - 1.2. Definition of macroscopic and microscopic anatomy
 - 1.3. Descriptive terms useful in the study of anatomy
2. **Physiological organ-systems**
3. Body fluid compartments and the ionic composition of body fluids.
4. Movement of water and solutes between the fluid compartments.
5. **The concept of homeostasis**
 - 5.1. Set point
 - 5.2. Negative and positive feedback loops

- 5.3. Compensatory responses.
6. **Structure of biological membranes.**
 - 6.1. Function of biological membranes
 - 6.2. The role of membrane proteins in catalysis, recognition, and transport.
7. **Intracellular and extracellular communication systems.**
8. **Organization structural and functional organization of the nervous system**
 - 8.1. The central and peripheral nervous systems
 - 8.2. The autonomic nervous system
 - 8.3. The enteric nervous system.
9. **The resting membrane potential.**
10. The action potential, action potential propagation along the axon.
11. Chemical messenger molecules of the nervous system, including classical and nonclassical neurotransmitters.
12. Synaptic neurotransmission.
13. Basic principles of sensory physiology.
14. Vision physiology.
15. Hearing physiology.
16. **Structure and function of skeletal muscle**
 - 16.1. Excitation-contraction coupling
 - 16.2. Sliding filament mechanism
 - 16.3. Force generation
 - 16.4. Isometric versus Isotonic contractions.
17. Structure and functions of the cardiovascular system
18. Excitation-contraction coupling in cardiac muscle
19. Reflex regulation of blood pressure
20. Structure and functions of the respiratory system
21. Regulation of ventilation.
22. Structure and functions of smooth muscle
23. Principles of hormone action
24. Functions of the endocrine system

25. The renin-angiotensin-system.
26. Structure and functions of the kidney

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours practicals

Assessment

Continuous Assessment **40 %**

2 assignments/practicals 30%

2 Tests 10%

Final Examination **60 %**

Practical examination 20%

Theory examination 40%

Prescribed Readings

1. Rowen D. Frandson (2003). *Anatomy and Physiology of Farm Animals*. by R.D. Frandson, Francis Smith, W. Lee Wilke, Anna Dee Fails, David Troy (Editor), Christina Remsberg (Produced by), **ISBN 0781733588**, ISBN13: 9780781733588
2. Christopher, M. D., and Patricia, S. M. (2015). *Principles of Animal Physiology*. (3rdEd.). Pearson / Benjamin Cummings, San Francisco **Recommended Readings**
3. Hill, R.W., Wyse, G.A. and Anderson, M. (2016). *Animal Physiology*. (4th Ed.). Sinauer, Sunderland, MA.
4. Garret, P.D. (1988). *Guide to Ruminant Anatomy based on Dissection of the Goat*. Iowa State University Press. ISBN: 0608079200, 9780608070202.

COURSE TITLE : ANIMAL BIOCHEMISTRY

COURSE CODE : CHE 221

PREREQUISITES : INTRODUCTORY BIOLOGY AND CHEMISTRY

Aim

This course is intended to be taught to animal science students as a foundation course for physiological and anatomical courses.

Learning Outcomes

Upon completion of this course, students should be able to:

1. Define the term Biochemistry;
2. Describe the biomolecules and their importance to animal life
3. Illustrate various metabolic pathways
4. Identify the various biomolecules by carrying out qualitative and quantitative tests
5. Describe nutrients and their importance to animal life

Course Outline

- 1.0 **Introduction**
- 1.1 Definition of Biochemistry, brief history, importance in animal nutrition, biotechnology and veterinary medicine.
- 1.2 Review of organic chemistry, Stereochemistry, a basic overview of major types of biochemical reactions (oxidations, reductions, condensations, isomerization, mutation, carboxylation and decarboxylation).
- 1.3 Brief review of Biomolecules (elemental composition and function)
 - 1.3.1 Proteins
 - 1.3.2 Carbohydrates
 - 1.3.3 Lipids

1.3.4 Nucleic Acids

2.0 **Proteins**

2.1 Definition

2.2 Classification of proteins on their functional basis i.e. catalytic, transport, nutrient, motile (contractile), structural, defence and regulatory proteins.

2.2.1 Basic physical and chemical properties

2.2.2 pH and pKa determinations (titration curves of amino acids)

2.2.3 Role of buffers in biological systems (blood, phosphate, bicarbonate)

2.2.4 Stereochemistry of amino acids

2.2.5 Definition and classification of simple proteins (i.e. albumins, globulins, glutenins, prolamines, albuminoids, histones and protamines), and conjugated proteins (i.e. nucleoproteins, phosphoproteins, chromoproteins, glycoproteins, lipoproteins and metalloproteins).

2.2.6 Protein structure (primary, secondary, tertiary e.g. myoglobin, quaternary
e.g. Haemoglobin)

2.2.7 Importance of correct folding-prions

2.2.8 Biological value

3.0 **Protein Metabolism**

3.1 Protein turnover (synthesis and degradation), fate of dietary amino acids (under starving and non-starving conditions), oxidative deamination, reductive deamination, transamination, reductive decarboxylation, the urea cycle and urine composition

3.2 Amino acid uptake

3.3 Overview of abnormalities associated with Amino Acid and Protein metabolism

4.0 **Carbohydrate Metabolism**

4.1 Structures, reactions and importance of glycolysis; alcoholic fermentation, Krebs's cycle, glyconeogenesis and the Cori Cycle, the pentose phosphate pathway, glycogenesis, glycogenolysis (and their regulation); links between carbohydrate and the metabolism of proteins and lipids

4.2 Sugar uptake

- 4.3 Overview of carbohydrate metabolic disorders
- 5.0 **Lipids**
 - 5.1 Definition and classification of lipids
 - 5.2 Nomenclature of fatty acids
 - 5.3 Lipid metabolism
 - 5.3.1 Oxidation and biosynthesis of fatty acids, formation and degradation of ketone bodies, dietary lipids, storage of triacyl glycerols, essential fatty acids and general functions of lipids.
 - 5.3.2 Metabolic disorders of lipids
 - 5.3.3 Fatty acid uptake
- 6.0 **Nucleic Acids**
 - 6.1 Structure and properties of purine and pyrimidine bases, nucleosides, nucleotides Nucleic acids. An overview of Cancer, use of nucleoside analogues as therapeutics.
HIV biochemistry; genetic makeup, key proteins, current therapeutics.
 - 6.2 Protein synthesis
 - 6.2.1 Flow of information from DNA to RNA to protein
- 7.0 **Principles of Bioenergetics**
 - 7.1 Chemical thermodynamics.
 - 7.2 Standard free energy change of reactions.
 - 7.3 Reaction coupling mechanism.
 - 7.4 Oxidation-reduction reactions.
 - 7.5 Energy-rich compounds.
- 8.0 **Enzymes**
 - 8.1 Definition and classification
 - 8.2 Basic overview of enzyme mechanism and catalysis
 - 8.3 General properties of enzymes,
- 9.0 **Vitamins**
 - 9.1 Definition and classification
 - 9.2 Physical and chemical properties
 - 9.3 Biochemical functions (coenzymes)

9.4 Deficiency (signs and symptoms)

9.5 Toxicity

10.0 Minerals

10.1 Definition and classification

10.2 Absorption of minerals (sodium, potassium, calcium, phosphorus, magnesium, cobalt, copper, iron, molybdenum, selenium, manganese, zinc, chromium, iodine, fluoride and chloride)

10.3 Biochemical functions

10.4 Deficiency (signs and symptoms)

10.5 Toxicity

10.6 Interactions of nutrient transportation absorption and utilisation

10.6.1 Vitamin and mineral (e.g. Vitamin C and iron; calcium, phosphorus and vitamin D)

10.6.2 Proteins, fats and vitamins

11.0 Biotechnology in Animal Science

11.1 Definition of animal science terms

11.2 Methods of biotechnology used in animal science

11.3 Distinguishing between traditional animal breeding and genetic engineering of animals

12.0 Methods biotechnology may be used to make changes in animals and animal products

13.0 Define terms relating to immunology

14.0 Methods of stimulating an immune response

Assessment

Continuous assessment	40%
2 Continuous assignments	10%
2 Practicals	30%
Final examination	60%

Prescribed Textbooks

1. Jain, J.L., Jain, S and Jain, N. 2005. *Fundamentals of Biochemistry* 6th ed. S. Chand. ISBN: 81-219-2453-7
2. Campbell M.K and Farrell S.O. 2009. *Biochemistry* 6th ed. Thomson Brooks/Cole, Belmont, CA (USA). ISBN-13: 978-0-495-39041-1 ISBN-10: 0-495-39041-0
3. Berg, J.M., Tymoczko, J.L and Stryer L. 2012. *Biochemistry* 7th ed. WH Freeman & Company, New York ISBN-10: 0-7167-3051-0

Recommended Books

1. Voet D and Voet JG. 2011. *Biochemistry* 4th ed. John Wiley & Sons, New Jersey. ISBN 9780470570951
2. Kuchel, P.W. (Coordinating Editor) 2009. *Schaum's Outlines Biochemistry* 3rd ed. Mc Graw Hill, New York ISBN: 978-0-07-1472272
3. Voet, D., Voet, G.V. and Pratt, C.W. 2008. *Fundamentals of Biochemistry: Life at molecular level* 3rd ed., Wiley publishers ISBN: 978-0-470-120930-2
4. Conn, E. E. (2005). *Outlines of Biochemistry*. 5th Edition. Published by John Wiley. ISBN -9971511649; ISBN -13: 9789971511647.
5. Lehninger, A.L., Nelson, D. L. and Cox, M.M. (2013). *Principles of Biochemistry*. 6th Edition. Worth Publishers. New York. ISBN-10: 1464109702 or ISBN-13:9781464109706

2.3 COURSE TITLE: PRINCIPLES OF AGRO CLIMATOLOGY

COURSE CODE : AEN 231

PRE-REQUISITES : NONE

Aim

The aim of the course is for students to understand the nature of the climate system and its processes, thereby, make decisions on what livestock and crops to keep and grow respectively.

Learning Outcomes

Upon successful completion of this course, students should be able to:

1. Explain the effects of different climatic variables on agriculture;
2. State the impact of climate change and global warming on agriculture;
3. Identify the equipment used in measurement of climatic variables and crop response to different climatic factors; and
4. Determine different cropping systems in relation to climate and the relevance of irrigation practices to increase crop productivity.

Course outline

1. Climate system

- 1.1. Environmental factors
- 1.2. Network of meteorological stations
- 1.3. Remote sensing in meteorology

2. Atmosphere physics

- 2.1. Air composition
- 2.2. Atmosphere stratification, gas state equation
- 2.3. Ozone Layer

3. Radiation and energy balance

- 3.1. Sun radiation, forms and types
- 3.2. Shortwave and long wave radiation, biological effects
- 3.3. Energy fluxes
- 3.4. Greenhouse effect, global warming

4. Meteorological elements

- 4.1. Air and soil temperature, temperature sums
- 4.2. Air moisture
- 4.3. Evapotranspiration, real, reference, potential
- 4.4. Hydrometeors, clouds
- 4.5. Air pressure, wind
- 4.6. Agro climatological impacts of individual meteorological elements

5. Circulation of atmosphere

- 5.1. Primary, secondary, tertiary circulation
- 5.2. Air masses

6. Synoptic meteorology

- 6.1. Cyclone, anticyclone
- 6.2. Atmospheric fronts
- 6.3. Types of weather forecast

7. Climatology

- 7.1. World climate - Koeppen classification
- 7.2. Climate of Africa
- 7.3. Climate of Zambia
- 7.4. Agroclimatological study related to specific plant growth and development

Duration: 15 weeks

Contact Hours

3 hours lectures per week

1 hour practicals per week

Assessment

Continuous Assessment	40 %
2 Assignments	20%
2 Tests	20%
Final Examination	60 %

Prescribed Readings

1. Monteith, J. L. (1975). *Vegetation and the Atmosphere*. J.L. Monteith, (Ed). London: Academic Press. ISBN: 0-12-505101-8.
2. Brutsaert, W. (1982). *Evaporation into the Atmosphere: Theory, History and Applications*. London: Reidel Publishing Company. ISBN: 90-277—1274-6.
3. Mavi, H. S. (2018). Introduction to Agrometeorology. Oxford and IBM Publishing Company. ISBN: 10:8120409108

Recommended Reading

1. Jones, G.H., (1983). *Plants and microclimate. A quantitative approach to environmental plant physiology*. New York: Cambridge University Press. ISBN: 0 521 27016 2.

COURSE TITLE	:	ENTREPRENEURSHIP AND INNOVATION
COURSE CODE	:	AEC 241
PRE-REQUISITES	:	NONE

Aim

At the end the course the students will gain knowledge of the context, concepts and process of entrepreneurship

Learning Outcomes

Upon successful completion of this course the students should be able to:

1. State the meaning of entrepreneurship and its different classifications;
2. Explain the importance of entrepreneurship as a tool for development;
3. Describe the typologies of entrepreneurship, the financial sources for startups, the modes of business networking; and
4. Design business plans.

Course outline

1. Entrepreneurship: Concepts and evidence
 - 1.1. Introduction to entrepreneurship
 - 1.2. Entrepreneurship paradigm
 - 1.3. Entrepreneurial personality/traits
 - 1.4. Socio behavioral approaches
 - 1.5. Entrepreneurship models/Theoretical approaches
2. Entrepreneurial activities & importance of small firms

- 2.1 Definition and measurements
- 2.2 Importance of entrepreneurship for economic growth and development
- 2.3 Changing role of small firms
- 2.4 Entrepreneurship in transitional economies
- 3. Diversity among entrepreneurs
 - 3.1 Indigenous entrepreneurs
 - 3.2 Immigrant entrepreneurs
 - 3.3 Women entrepreneurs
 - 3.4 Youth entrepreneurs
- 4. Personality traits of the entrepreneur
 - 4.1 Motivation and demographics.
 - 4.2 Similarities and differences between entrepreneurs and managers.
- 5. Zambia's entrepreneurial environment
 - 5.1 Natural resources as they relate to entrepreneurship
 - 5.2 The informal sector growth in Zambia
- 6. Economic trends in Zambia
 - 6.1 Government's policy on entrepreneurship
 - 6.2 Policy instruments supporting enterprise development
 - 6.3 Enterprise development support system available in Zambia
 - 6.4 Legal framework affecting enterprise development

Duration: 15 weeks

Contact Hours

3 hours lectures per week

1 hour tutorial

Assessment

Continuous Assessment	40 %
Assignment	10%
Tests	30%
Final Examination	60 %

Prescribed Readings

1. Marlow, S. and Strange, S. (1994). *Female entrepreneurs; Success by whose standards*. In: Marlow S., Strange, S. and Tanton, M.; Women in management: a developing presence: London Routledge
2. Fayolle, A. (2007). *Entrepreneurship and new value creation*. Cambridge: Cambridge University Press.
3. Hougaard, S. (2005). *The business idea*. Berlin, Springer
4. Lowe, R and Mariott, S. (2006). *Enterprise: Entrepreneurship & Innovation*. Burlington, ButterworthHeinemann.

Recommended Readings

1. Deakins, D and Freel, M. (2006). *Entrepreneurship and small firms*. (4th Ed.). McGraw-Hill Education, Berkshire.
2. Barringer, B. R. and Ireland, R. D. (2012). *Entrepreneurship - Successfully Launching New Ventures*. (4th Ed.). Pearson Education Inc, USA. ISBN: 978-0-13-255552-4.
3. Timmons, J. A and Spinelli, S. (2009). *New Venture Creation*. (8thEd.). McGrawHill.

COURSE TITLE : ZOOLOGY

COURSE CODE : BIO 251

PRE-REQUISITES : INTRODUCTORY BIOLOGY

Aim

At the end of the course the students will gain knowledge of Cells, Tissues, Organs and Systems of animals and its Taxonomical classification.

Learning Outcomes

Upon successful completion of the course, students should be able to:

- Demonstrate and understand the structure and functions of cells & tissues
- Determine the structure and functions of organs and systems
- Explain the taxonomical classification of animals
- Define external morphology and function, internal anatomy and physiology of insects
- Describe the relations of organisms to one another and to their physical surroundings

Course Outline

1. Introduction
 - 1.1 Definition of Zoology in relation to other sciences
 - 1.2 Importance of Zoology in crops and animal sciences
2. The Cell
 - 2.1 Definition
 - 2.2 Cell theory
 - 2.3 Cell structure and function
3. Tissues, Organs and Systems
 - 3.1 Definition of tissues
 - 3.2 composition and function of epithelia tissues
 - 3.3 connective tissues
 - 3.4 skeleton muscles
 - 3.5 smooth muscles
 - 3.6 cardiac muscles nervous tissues and reproductive tissues
 - 3.7 organ definition and typical structure
 - 3.8 definition and examples of system
4. Taxonomy
 - 4.1 Definition
 - 4.1.1 a basic view of the five kingdom system of classification
 - 4.1.2 meanings of data species definition
 - 4.1.3 kingdoms monera, protista, fungi, plantae, animalia
5. Protozoa
 - 5.1 Definition
 - 5.1.1 characteristics and importance
 - 5.1.2 life cycles and symptoms of anaplasmosi, babesiosis, coccidiosis Malaria, Therileriosis, trypanosomaisis, pyorrhoea, amoebic dysentery
6. Plathyhelminthes
 - 6.1 Definition
 - 6.2 Characteristics
 - 6.3 Classification and importance
 - 6.4 Symptoms and life cycles of parasite in faciliasis, schistosomiasis and taeniasis

7. Aschelminthes
 - 7.1 Characteristics
 - 7.2 Classification and importance
 - 7.3 Life cycles and symptoms of the parasite in ascariasis, a comment on other round worms
8. Annelida
 - 8.1 Definition
 - 8.2 Characteristics
 - 8.3 Classification and importance
9. Arthropoda
 - 9.1 Definition
 - 9.2 Characteristics
 - 9.3 Classification and importance
10. Entomology
 - 10.1 Definition, external morphology and function, internal anatomy and physiology (reproductive, circulatory, digestive, respiratory and nervous systems, metamorphosis).
11. Insect Pests and Parasites
 - 11.1 A brief view of stalk borers, swallow tails, aphids, scale insects, cabbage moths, cotton boll worms, bean steam fly, bean pod fly, tobacco white fly termites, cutworms, leaf rollers, jassids, mealy bugs, borers, weevils, leas, lice.
12. Arachnid Pests and Parasites
 - 12.1 A brief view of ticks, mites (both and mammal mites, pests mites) and their importance
13. Mollusca
 - 13.1 Definition
 - 13.2 Characteristics

13.3 Classification and importance as disease vectors, sources of food, pests on vegetables, boat destruction etc.

14. Chordata

14.1 Definition

14.2 Classification and characteristics

14.3 Classification of mammals into orders

15. Poisonous Snakes

15.1 A brief view of vipers, elapids and colubrids

15.2 Symptoms and first aid of snake bites

16. Aves (Birds)

16.1 General characteristics

16.2 Classification

16.3 Physiology (reproductive, digestive and respiratory systems), eggs structure and incubation

17. Mammalia

17.1 Basic characteristics

17.2 Physiology (reproductive, digestive ruminant and non-ruminant), respiratory, circulatory and lymphatic system)

17.3 Basic abnormalities in digestion and reproduction, estrus detection

18. Ecology

18.1 Definition of ecology

18.2 Community

18.3 Population

Duration: 15 weeks

Contact Hours

3 hours lectures per week

3 hours Practicals per week

Assessment

Continuous Assessment 40%

Tests 30%

Practicals	10%
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Final Examination **60%**

Prescribed Readings

1. HICKMAN: Integrated Principles of Zoology
2. ICERKUT: The Invertebrata
3. WEISZ KEOGH: The Science of Biology
4. VILLEE, WALKER, SMITH: General Zoology
5. GALBRAITA, WILSON: Biological Science

Recommended Readings

6. PFADT: Fundamentals of Applied Entomology
7. HORN: The biology of insects
8. HALL: Disease and Parasite of Livestock in the Livestock in the Tropics
9. RANDSON: Anatomy and Physiology of Farm Animals
10. ODUM: Fundamentals of Ecology

COURSE TITLE : **FARM STRUCTURES**

COURSE CODE : **AEN 222**

PRE-REQUISITES : **NONE**

Aim: To equip students with the basic Principles of Rural Structures, to enable them analyse, design and erect simple farm and associated structures with special emphasis on economic viability and environmental issues.

Learning Outcomes

Upon successful completion of this courser, students will be able to:

- i. Plan a farmstead
- ii. Select desirable materials for a particular structure
- iii. Describe the various types of building material on the market
- iv. Demonstrate how to use materials for construction works
- v. Design any farm structure using engineering principles
- vi. Demonstrate how to construct various rural structures.
- vii. Apply basic principles of farm structures in structural elements.
- viii. Calculate bill of quantities for farm structures

Course Outline

- 1.0 **Introduction to farm structures**
- 1.1 Definitions of terms
- 2.0 Farmstead planning
- 2.1 Siting a farmstead
- 2.2 Zone planning

- 3.0 **Building materials**

- 3.1 Soil
 - 3.1.1 Soil classifications
 - 3.1.3 Testing for suitability for building purposes
 - 3.1.4 Stabilizing of soil
 - 3.1.4 Burnt bricks
- 3.2** Concrete
 - 3.4.1 Concrete composition
 - 3.4.2 Factors affecting strength
 - 3.4.3 Concrete batching
 - 3.4.4 Slump test,
 - 3.4.5 Placing and compaction,
 - 3.2.5 Compaction methods
 - 3.2.6 Curing.
 - 3.2.7 Reinforced concrete
- 3.5 Timber
 - 3.5.1 Composition
 - 3.5.2 Structure
 - 3.5.3 Strength
 - 3.5.4 Defects of timber
 - 3.5.5 Preservation and protection of timber
 - 3.5.6 Seasoning of timber
 - 3.5.7 Uses of timber
- 3.6 Other building materials
 - 3.6.1 Bamboo
 - 3.6.2 Thatch
 - 3.6.3 Corrugated iron sheets,

- 3.6.4 Asbestos cement sheets
- 3.6.5 Fibre reinforced cement tiles.

- 4.0 **Construction details**
- 4.1 Foundation and footings
 - 4.1.1 Common foundations
 - 4.1.2 Soil stress calculation
 - 4.1.3 Construction details
- 4.2 Floors
 - 4.2.1 Construction details
 - 4.2.2 Common types of floors
 - 4.2.3 Damp proofing
 - 4.2.4 Ant guards
- 4.3 Walls
 - 4.3.1 Construction details
 - 4.3.2 Common types of walls
 - 4.3.3 Types of bonding for burnt bricks
 - 4.3.4 Beams and lintels
- 4.4 Fixed installations
 - 4.4.1 Doors
 - 4.4.2 Windows
 - 4.4.3 Miscellaneous
- 4.5 Roof structure
 - 4.5.1 Trusses
 - 4.5.2 Poles
 - 4.5.3 Load requirements
 - 4.5.4 Construction techniques
- 4.6 Structural Design

- 4.6.1 Design standard tables
- 4.6.2 British Standard (BS. 8110 student guide)

5.0 **Planning of building**

5.1 Assessment of Requirements

5.2 Plans and drawings

5.3 Cost estimation

5.3.1 Bill of quantities

5.4 Time schedule; Network analysis

5.5 Supervision

6.0 **Specific building design**

6.1 Low cost residential Building+s

6.2 Cattle structures

6.3 Piggery structures

6.4 Poultry house

4.5 Storage structures

7.0 **Building tools**

7.1 Common tools

8.0 **Building implementation**

8.1 Provision of drawings

8.2 Local Authority laws and regulations

8.3 Procurement

8.2 Enrolment of institutions

Assessment

Continuous

40%

Final examination

60%

Prescribed Textbooks:

1. FAO Publication 1986: Farm structures in tropical climate. ASIN: B009PO0DFO
2. W. H. Mosley & J H Bungay: Reinforced concrete design. ISBN-13: 978- 0230302853
3. IT Publication 1981: Appropriate building materials. ISBN-13: 978-1853392252
4. Callaway: Buildings in the tropics. ISBN-13: 978-3766705365

Reference Manuals

1. MACO Agricultural Engineering publications 1989:
 - i) Farm Buildings
 - ii) Farm Dwellings
2. BS 8110 – Student guide

COURSE TITLE : CLIMATE CHANGE AND VARIABILITY

COURSE CODE : **AEN 232**

PRE-REQUISITES : **NONE**

Aim

This course will equip students with knowledge and skills to observe, understand, and predict climate variability and change.

Learning Outcomes

Upon successful completion of this course the students should be able to:

1. Describe the source and processing of data that is used to reconstruct past climates and assess changes in climate and atmospheric composition;
2. Describe how the climate has changed in the recent past in the context of changes that have occurred more generally in the past and the techniques used for attributing the causes;
3. Apply physical and dynamical reasoning to explain the causes of internally generated climate
4. Apply physical and dynamical reasoning to explain the causes of externally forced climate change (including the influence of human activity), and the source of uncertainty in understanding these causes;
5. Assess the major impacts of climate variability and change, and outline the adaptation and mitigation strategies that are applied in response to current and projected changes in the climate;
6. Explain the differences between climate models and those used for weather prediction, explain why there are uncertainties in climate predictions, describe how climate predictions can be verified, and explain why there are differences between statistical intra-annual forecasts and climate model predictions.

Course outline

1. Introduction to climate change science

- (a) What is climate change;
- (b) Climate change and biodiversity in context

2. Review of climate types

- a. Tropical
- b. Equatorial
- c. Temperate
- d. Polar

3. Spatial and Temporal Trends in local and world climate

- 2.1 Climate variability
- 2.2 Climate change
- 2.3 Data to assess climate spatial and temporal trends
- 2.4 Observed local, regional and globally climate variations

4. Factors influencing Climate change and climate variability

- 3.1 Major Oscillation regimes (ENSO-Ocean interactions, MJO, NAO)
- 3.2 External factors
- 3.3 Other

5. Concepts of climate prediction and modeling

- 4.1 Atmospheric general circulation models
- 4.2 Oceanic general circulation models
- 4.3 Coupled Atmospheric /oceanic models
- 4.4 Land use greenhouse emissions general models

6. Impacts of adaptation to climate variability and change

- 5.1 Human
- 5.2 Wildlife
- 5.3 Water, Land and other natural resources
- 5.4 Vegetation

7. Adaptation strategies:

- a. Definitions and concepts of adaptation.
- b. Types of adaptation;
 - i. Anticipatory and reactive adaptation,
 - ii. Private and public adaptation,
 - iii. Autonomous and planned adaptation.

8. Determinants of adaptation;

- c. System characteristics that influence a system's propensity to adapt - sensitivity, vulnerability, resilience, susceptibility, impact potential, responsiveness, adaptive capacity, adaptability.

9. Forests and farming systems response to climate change:

- a. Role of forests and farming systems in adaptation to climate change.
- b. Resilience of flora and fauna to climate change.
- c. Forest-based adaptation strategies/measures.
- d. Non-forest based adaptation strategies:

10. Sectoral adaptation measures:

- a. Adaptation strategies in agriculture,
- b. Other adaptation strategies,
- c. Planning and cross-sectoral coordination as adaptation strategies.

11. Mitigation strategies:

- a. Concepts and definition of carbon sequestration.
- b. Role of forests and crops in climate change mitigation.
- c. Managing forests and crops for climate change mitigation.

12. Legislations and policies on climate change mitigation:

- a. Forest based mitigation strategies of climate change.
- b. Agricultural based climate change mitigation strategies.

13. Sectoral mitigation measures:

- a. Mitigation strategies through smart alternative livelihoods as climate change mitigation measures.
- b. Resource substitution as a mitigation measure (e.g. renewable energy)

Suggested practicals

1. Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording.
2. Measurement of total, shortwave and longwave radiation, and its estimation using Planck's intensity law.
3. Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS.
4. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis.
5. Measurement of soil temperature and computation of soil heat flux.
6. Determination of vapor pressure and relative humidity.
7. Determination of dew point temperature.
8. Measurement of atmospheric pressure and analysis of atmospheric conditions.
9. Measurement of wind speed and wind direction, preparation of windrose.
10. Measurement, tabulation and analysis of rain.
11. Measurement of open pan evaporation and evapotranspiration.
12. Computation of PET and AET.

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours tutorials

Assessment

Continuous Assessment **40 %**

Assignments 10%

Tests	30%
Final Examination	60 %

Prescribed Readings

1. Hunter, L. M. (2000). *The Environmental Implications of Population Dynamics*, RAND Corporation, Santa Monica.
2. UN. (1994). *Population, Environment and Development: Proceedings of the United Nations Expert Group Meeting on Population, Environment and Development*, United Nations, New York. Prescribed
3. Beder, S. (2007). *Environmental Principles and Policies - An Interdisciplinary Introduction*. Earthscan, UK.
4. Cooney, R and Barney D. (Eds.). (2006). *Biodiversity and the Precautionary Principle - Risk and Uncertainty in Conservation and Sustainable Use*, Earthscan, UK

Recommended Readings

1. Pearson, R. (2011). *Driven to Extinction: The Impact of Climate Change on Biodiversity*. The Natural History Museum
2. Hollo, J. E., Kulovesi, k., and Mehling, M. (2013). *Climate Change and the Law (IusGentium: Comparative Perspectives on Law and Justice)*. Springer
3. Hepburn, C., and Helm, D. (2011). *The Economics and Politics of Climate Change*. OUP Oxford

COURSE TITLE	:	FIELD CROP PRODUCTION
COURSE CODE	:	CSC 242
PRE-REQUISITES	:	NONE

Aim

The course is intended to provide students the scientific principles required for successful production and management of different field crops.

Learning Outcomes

Upon successful completion of this course the students should be able to:

1. Acquire skill in crop production
2. Apply various agronomic practices that can bring about improved crop yield.
3. Control pest, weeds, and diseases for enhanced yield.

Course content

1. Classification of field crops
 - 1.1 Introduction
 - 1.2 Classification
 - 1.3 Cereal crops
 - 1.4 Pulse crops
 - 1.5 Oil seed crops
 - 1.6 Fibre crops

1.7 Sugar crops

1.8 Green manure crops

2. Cropping systems

2.1. Methods of cropping

2.2. Types of sequential cropping

2.3. Intercropping

2.4. Benefits of intercropping

2.5. Limitation of intercropping

2.6. Criteria for selection of crops for intercropping system

2.7. Types of intercropping

2.8. Principles of crop rotation

3. Green manuring

3.1. Methods of green manuring

3.2. In-situ green manuring

3.3. Ex-situ green manuring/Green leaf manuring

3.4. Green manuring practices

4. Management and climatic conditions for crops

4.1 Maize

4.2 Sorghum

4.3 Soybean

4.4 Groundnut

4.5 Sunflower

5. Fodder crops

5.1 Classification

5.2 Legume fodder

5.3 Perennials

5.4 Forage legumes

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours practicals

Assessment

Continuous Assessment **40 %**

Practical 30%

Tests 10%

Final Examination **60 %**

Prescribed Reading

1. Onwueme, I. C. and Sinha, T. D. (1999). *Field Crop Production in Tropical Africa*. Netherlands: CTA, Wageningen, pp. 1-14.

Recommended Readings

1. Russell, E. M. (2011). *Plant Production Systems: Food, Fuel, Feed, Fiber*. (5thEd.). Kendall Hunt Publishing. ISBN: 10-146524023.
2. Conservation Farming Unit. (2009). A handbook for Hoe Farmers in Agro-ecological Regions I and IIa-Flat Culture.
3. MAFF. (1997). Zambia Seed technology handbook. Berlings, Sweden. ISBN NO: 998208-000-8.

2.9 COURSE TITLE : FARM MANAGEMENT

COURSE CODE : AEC 252

PRE-REQUISITES : FARM ACCOUNTS

Aim

To introduce the learners to the management function and practice of planning as it relates to the farm business.

Objectives

Upon successful completion of this course, students should be able to:

1. Explain the concept of farm management;
2. State the key functions of management;
3. Explain the importance of farm records and depreciation; 4. Develop skills of considering farm as a business entity; and
5. Conduct a farm business analysis.

Course outline

1. Management
 - 1.1. Definition of farm management
 - 1.2. Scope of farm management
 - 1.3. Goals of the farmer
 - 1.4. Firm life cycle
 - 1.5. Role and functions of management
2. Farm records
 - 1.1 Categories of farm records
 - 1.2 Importance of farm records
3. Farm Accounts
 - 3.1. Farm Accounting
 - 3.2. Information and statements:
 - 3.3. The need for a farm accounting system;
 - 3.4. The Cash Flow statement;

- 3.5. Income statement;
- 3.6. The Balance Sheet;
- 3.7. Accounting ratios.
- 3.8. Developing enterprise
4. Budgeting
 - 1.1 Definition
 - 1.2 Cash flow budgeting
 - 1.3 Enterprise budgeting
 - 1.4 Determination of Optimum Input and Output
 - 1.5 Competitiveness; Rates of substitution
 - 1.6 Partial Budgeting
 - 1.7 Complete budgeting
 - 1.8 Gross margin analysis
 - 1.9 Break even analysis
5. Review of Marginal Analysis and Cost concepts;
 - 5.1. Cost of Machinery;
 - 5.2. Cost of Building Services;
 - 5.3. Seasonal Input Requirements;
 - 5.4. Generating Enterprise Budgets.
6. Farm Planning
 - 6.1. Goals, Resources, and Restrictions;
 - 6.2. Long Run Planning;
 - 6.3. Short Run Planning; 6.4 Intermediate Planning.
7. Market:
 - 7.1. Marketing Decisions; 7.2 Steps in Market Planning;
 - 7.3 Pricing.
8. Tax Management
9. Planning the Farm Business Arrangement:

9.1. Business Arrangement Alternative;

9.2. Present Situation and the Potential

10. Economics Risks in Livestock and Aquaculture production business

Practicals

1. Preparation of a farm layout.
2. Determination of cost of fencing of a farm.
3. Computation of depreciation cost of farm assets.
4. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources.
5. Determination of most profitable level of inputs use in a farm production process.
6. Determination of least cost combination of inputs.
7. Selection of most profitable enterprise combination.
8. Application of cost principles including the estimation of cost of crop and livestock enterprises.
9. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts.
10. Collection and analysis of data on various resources in Zambia.

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours tutorials

Assessment

Continuous Assessment	40 %
2 Assignments	30%
2 Tests	10%
Final Examination	60 %

Prescribed Readings

11. Kay, R. B., Edwards, W. M., and Duffy, P. A. (2004). *Farm Management*. (5th Ed.). McGraw-Hill Companies. ISBN: 0-07-242868-6.
12. Turner, J and Taylor, M. (1998). *Applied Farm Management*. (2nd Ed.). London: Blackwell Sciences Ltd.

Recommended Readings

1. Kay, R.D. (1986). *Farm Management*.
2. Sankhayan, P.I. (1980). *An Introduction to Farm Management*. Lusaka: University of Zambia.
3. Upton, H. (1979). *Farm Management in Africa*. Oxford University Press.

COURSE TITLE	:	FIELD ATTACHMENT I
COURSE CODE	:	ANS 262
PRE-REQUISITES	:	NONE

Aim

To strengthen the practical knowledge of students and their involvement in various horticultural projects

Learning outcomes

Upon successful completion of this course, the students should be able to:

1. To provide the student with practical on-the-job experiences in an extension service provider
2. Submit a written report of their activities and that of the field supervisor
3. Provide information of the activities in case the school intends to visit students in the field.
4. Intellectually and emotionally, and to recognize the strength of individual and collective difference within the organisation.

Course content

Practical

- Placement of students at various public and private organizations providing agricultural extension services to farmers
- Study, discussion and their practical involvement in ongoing extension programs/projects
- Performance of practical managerial duties or practical demonstration of important operations in the concerned programs
- Meet an employer's attendance, punctuality and reliability expectations
- Communicate effectively with others in the workforce
- Submission of report and oral presentation at the end of the semester

Assessment

Field attachment experience composite results shall be out of:

- | | |
|------------------------------|-----|
| a) Student report | 30% |
| b) Portfolio/File | 10% |
| c) Mentor's observation mark | 40% |

d) Lecturer's observation mark 20%
Total **100%**

Year Three:

SEMESTER I		SEMESTER II
ANS311 Fundamentals of Aquaculture		Animal Health
ANS321 Principles of Animal Nutrition		Poultry Production
ANS331 Animal Genetics		Animal Growth and Development
ANS341 Sheep, Goat and Rabbit Production		Applied Animal Nutrition
Applied Experimental Design and Analysis for	ANS312	
ANS351 Agricultural Research	ANS322	Pig production
ANS361 Field attachment II	ANS332	
	ANS342	
	ANS352	

COURSE TITLE : FUNDAMENTALS OF AQUACULTURE

COURSE CODE : ANS 311

PRE-REQUISITES : NONE

Aim

The aim of this course is to equip students with the basic principles and practices of aquaculture farming systems.

Learning Outcomes

By the end of this course, students should be able to:

1. Design and operate extensive and intensive culture facilities (ponds, net pens, flowthrough systems, recirculating aquaculture systems, integrated aquaculture operations, etc.)
2. Outline species-specific culture requirements (temperature, water quality etc.), and how to maintain optimal conditions in the various culture systems
3. State the practical aspects of aquaculture (feeds and feeding; stocking, transport, and harvest techniques; marketing and economics; disease prevention, diagnosis and treatment; etc.)

Course outline

1. Introduction to aquaculture
 - 1.1. International aquaculture perspective
 - 1.2. Regional (Zambia) aquaculture perspective
 - 1.3. Introduction to fisheries legal framework
 - 1.4. Aquaculture basics
2. Water sources and requirements
 - 2.1. Water recirculation systems

- 2.2. Farm ponds
- 2.3. Lake-ranching and other systems
- 2.4. Hatcheries
- 2.5. Chemical aspects of water quality
- 2.6. Physical aspects of water quality
3. Aquaculture management practices
 - 3.1. Site selection
 - 3.2. Pond construction
 - 3.3. Reservoir construction
 - 3.4. Pond and reservoir management
4. Fundamentals of nutrition in Aquaculture
 - 4.1. Natural and prepared feeds
 - 4.2. Vitamin and mineral requirements
 - 4.3. Protein demand
 - 4.4. Lipid and carbohydrate requirements
 - 4.5. Feeding strategies
 - 4.6. Broodstock management
5. Aquaculture genetics and ploidy manipulations
6. Health of Aquatic Animals
 - 6.1. Disease prevention and diagnosis
 - 6.2. Therapeutants in aquaculture
7. Harvest and transport techniques
8. Economics and marketing in aquaculture
9. Aquatic Structures and International Agencies and Regulations
10. Trends in domestic and global aquaculture

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours practicals per week

Assessment

Continuous Assessment	40 %
2 Assignments	10%
2 Tests	30%
Final Examination	60 %

Prescribed Readings

1. Pew Report. (2001). *Marine Aquaculture in the United States. Environmental Impacts and Policy Options*. Prepared for the Pew Oceans Commission. 2101 Wilson Boulevard,
Suite 550, Arlington, Virginia 22201.
2. Tidwell, H. H. (2012). Aquaculture production systems. (1st Ed.). Wiley-Blackwell.
3. Parker, R. O. (2012). Aquaculture species. (3rd Ed.). Oxford University Press.

Recommended Readings

1. Colt, J. (1991). Aquaculture production systems. *Journal of Animal Sciences*. 69:4183- 4192.
2. Shell, E. W. (1991). Husbandry of animals on land and in water: similarities and differences. *Journal of Animal Sciences*, 69: 4176-4182.
3. Cyprian. (2014). *Fisheries Management in Zambia Co-managing the Shared and Complex Resources-Case Studies of Mweru-Luapula and The Kafue Flats Fisheries; Zambia*. Saarbrücken: LAP LAMBERT Academic Publishing. ISBN-10: 3659530468; ISBN-13: 978-3659530463.

3.2 COURSE TITLE : PRINCIPLES OF ANIMAL NUTRITION

COURSE CODE : ANS 321

PRE-REQUISITES : ANIMAL PRODUCTION

Aim

The goal of this course is to teach students the basic concepts of animal nutrition so as to maximize profits for enterprises.

Learning Outcomes

Upon successful completion of this course, students should be able to:

1. Analyse nutritive requirements and scientific research needed for livestock; 2.

Explain the concepts of bioavailability and digestibility of nutrients;

3. Describe the various nutritional concepts used in practical diet formulation;

4. Outline the role of nutrition in the maintenance of health;

5. Formulate feed for livestock; and

6. State the basic techniques used in assessing nutritional value of feedstuffs.

Course outline

1. Introduction

2. Review of principles

3. Nutrition as a science

4. Water
5. Vitamin & mineral nutrition
6. Physiological stages of production
7. Feed carbohydrate chemistry
8. Feed energy utilization
9. Energy requirements for maintenance/growth
10. Body energy reserves during growth
11. Managing body energy reserves
12. Energy utilization/maintenance
13. Protein evaluation
14. Protein evaluation
15. Protein requirements for maintenance/growth
16. Feeding for reproduction
17. Feeding for lactation
18. Neonatal nutrition
19. Associative effects
20. Unique aspects of small ruminant nutrition
21. Unique aspects of dairy nutrition

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours practicals per week

Assessment

Continuous Assessment 40 %

2 Assignments/project 30%

2 Tests 10%

Final Examination 60 %

Prescribed Readings

1. Greenhalgh, J. F. D, Morgan, C. A., Edwards, R., and Peter, M. (2002). *Animal Nutrition*. Pearson Education Books.
2. Kellems, R, and Church, D. (2009). *Livestock Feeds and Feeding*. Pearson Education Books.
3. Robert, E. T, and Thomas, G. F. (2003). *Scientific Farm Animal Production. An Introduction to Animal Science*. Prentice Hall.

Recommended Readings

2. Pond, W. G., Church, D. C., Pond, K. R. and Schoknecht, P. A. (2005). *Basic Animal Nutrition and Feeding*, Wiley, Fifth Edition.
3. Gillespie, R .J. (1989). *Modern livestock and Poultry Production*. (4th Ed.). Delmar Publishers Inc. USA. ISBN: O-8273-3277-7

COURSE TITLE : **ANIMAL GENETICS**

COURSE CODE : **ANS 331**

PRE-REQUISITES : **NONE**

Aim

To equip students with some basic understanding of modern techniques of genetic evaluation of farm animals, and how genetic differences between individual animals as well as breed differences are utilized to improve animal characteristics in modern production systems

Objectives

Upon successful completion of this course the students should be able to:

1. Gain a clear understanding of principles of animal genetics and modern techniques of genetic evaluation.
2. Apply genetic principles and techniques to improve the economic value and performance of farm animals

3. Critically analyze and apply some of the animal improvement tools that are used notwithstanding their limitations.

Course outline

1. Breeds of farm animals and breed conservation
 - 1.1. Common farm animals
 - 1.2. Conservation of animal genetic resource
2. Genetic improvement-systems approach to genetic improvement
3. Mendelian principle of inheritance
 - 3.1 Mendel's laws and gene action
 - 3.2 Type of gene action at a single locus and at multiple loci
 - 3.3 Sex related inheritance and other forms of inheritance
 - 3.4 Mendelian genetics detrimental and lethal conditions of animals
4. Genetic differences
 - 4.1 Differences in chromosomal morphology
 - 4.2 Nucleotide bases as the genetic code found on the chromosomes.
 - 4.3 Classification of DNA sequences of chromosomes in the mammalian genome.
 - 4.4 Functional and pseudo gene sequences, Genome mapping
5. Genetic architect of a trait
 - 5.1 Gene interactions to produce specific phenotypes
6. Population genetics
 - 6.1 Gene and genotype frequencies.
 - 6.2 The Hardy-Weinberg law and how gene and genotypic frequencies change at a single or at multiple loci to re-establish equilibrium.
 - 6.3 The Hardy-Weinberg law and sex-linked loci.
 - 6.4 The effect of distance between linked loci on the disequilibrium value and recombination frequency
 - 6.5 Forces that change gene frequency
7. Quantitative genetics

8. Selection
9. Cross breeding **Duration:** 15 weeks

Contact Hours

3 hours lectures per week

2 hours tutorials

Assessment

Continuous Assessment	40 %
2 Assignments	10%
2 Tests	10%
Practical	20%
Final Examination	60 %

Prescribed Reading

1. Nicholas, F. W. (2000). *Introduction to Veterinary Genetics*. Oxford University Press.
2. Gupta, P. K. (2004). Cytology, Genetics and evolution. Rastogi Publications, Meerut. (Hindi Edition).
3. Klug, W. W. and Cummings, M. R. (2005). Concepts of genetics Pearson Education (Singapore) pvt. Ltd., Indian Branch, Pratap Ganj, New Delhi.

Recommended Reading

1. Bourdon, R. M. (2000). *Understanding Animal Breeding*. (2nd Ed.). Prentice Hall.
2. Strickberger, M. W. (2001). *Genetics*. Prentice Hall of india. Pvt. Ltd., New Delhi.

COURSE TITLE : SHEEP, GOAT AND RABBIT PRODUCTION

COURSE CODE : ANS 341

PRE-REQUISITES : ANIMAL PRODUCTION

Aim: To provide students with knowledge and skills of pig, rabbits and poultry management practice

Learning Outcomes

Upon successful completion of the course, students should be able to:

1. To explain the state and limitations of pig, rabbits and poultry industries in Zambia

2. To perform management operations in pig, rabbit and poultry industries

Course Outline

1.0 Goat Production

1.1 Introduction

- 1.1.1 Terminology
- 1.1.2 Distribution of goats in Zambia
- 1.1.3 Advantages of goats over other livestock
- 1.1.4 Breeds of goats and their uses

1.2 Breeding

- 1.2.1 Reproductive cycle
- 1.2.2 Signs of heat
- 1.2.3 Breeding practices
 - 1.2.3.1 Two breed crossing
 - 1.2.3.2 Three breed crossing
 - 1.2.3.3 Rotational crossing

1.3 Management

- 1.3.1 Breeding management
- 1.3.2 Selection of breeding stock
 - 1.3.2.1 Selection criteria and quantity to select
 - 1.3.2.1.1 Males
 - 1.3.2.1.2 Females
 - 1.3.2.2 Culling of breeding stock; Ageing by dentition
 - 1.3.2.2.1 Breeding seasons
 - 1.3.2.3 Breeding once a year
 - 1.3.2.4 Breeding twice per year
 - 1.3.2.5 Breeding thrice in three years
- 1.3.3 Feeding management
 - 1.3.3.1 Requirements and rations
 - 1.3.3.2 Breeding does

1.3.3.2.1 Flushing

1.3.3.2.2 Feeding during pregnancy

1.3.3.2.3 Feeding during lactation

1.3.3.3 Fattening kids

1.3.3.4 Mineral deficiency and supplementation

1.3.3.5 Iodine deficiency and supplementation

1.3.3.6 Provision of water

1.3.4 Health Practices

1.3.4.1 Control of internal parasites

1.3.4.1.1 Drenching

1.3.4.1.2 Rotational grazing

1.3.4.2 External parasite control; dipping

1.3.4.3 Annual vaccination programme for Goats

(see vaccination schedules)

1.3.5 Housing and fencing

1.4 Marketing and slaughter of goats

1.4.1 Slaughter techniques

1.4.2 Meat cuts

2.0 Sheep Production

2.1 Introduction

2.1.1 Terminology

2.1.2 Distribution of sheep in Zambia

2.1.3 Advantages of sheep over other livestock

2.1.4 Breeds of sheep and their conformation

2.2 Breeding

2.2.1 Reproductive cycle

2.2.2 Breeding practices

2.2.2.1 Two breed crossing

2.2.2.2 Three breed crossing

2.2.2.3 Rotational crossing

2.3 Management

2.3.1 Breeding management

2.3.2 Selection of breeding stock

2.3.2.1 Selection criteria and quantity to select

2.3.2.1.1 Males

2.3.2.1.2 Females

2.3.2.2 Culling of breeding stock; Ageing by dentition

2.3.3 Breeding seasons

2.3.3.1 Breeding once a year

2.3.3.2 Breeding twice per year

2.3.3.3 Breeding thrice in three years

2.3.4 Feeding management

2.3.4.1 Requirements and rations

2.3.4.2 Breeding ewes

2.3.4.2.1 Flushing

2.3.4.2.2 Feeding during pregnancy

2.3.4.2.3 Feeding during lactation

2.3.4.3 Fattening lambs

2.3.4.3.1 Mineral deficiency and supplementation

2.3.4.3.2 Iodine deficiency and supplementation

2.3.4.4 Provision of water

2.3.5 Health Practices

2.3.5.1 Control of internal parasites

2.3.5.1.1 Drenching

2.3.5.1.2 Rotation of grazing

2.3.5.2 External parasite control; dipping

2.3.5.3 Annual vaccination programme

- 2.3.6 Housing and fencing
- 2.4 Marketing and slaughter of sheep**
 - 2.4.1 Slaughter techniques
 - 2.4.2 Meat cuts
- 3.0 Rabbit production**
 - 3.1 Introduction**
 - 3.1.1 Definition of common terms
 - 3.1.2 Principal breeds for meat production
 - 3.1.3 Other breeds; Fur Breeds, Crossbreeds, Hybrids
 - 3.2 Reproduction and breeding**
 - 3.2.1 Reproductive behaviour of the doe
 - 3.2.2 Breeding systems
 - 3.3 Management**
 - 3.3.1 Breeding management
 - 3.3.2 Identification
 - 3.3.3 Handling: Sexing, Restraint during mating, administration of medicines, Claw cutting.
 - 3.4 Feeding**
 - 3.4.1 Feeds for rabbits; Roughage and green foods, cereal grains, waste bread, all-purpose pellets
 - 3.4.2 Nutrient requirements; Protein, Energy, Vitamins, Minerals, Water
 - 3.4.3 Feeding management
 - 3.5 Housing: Systems of housing**
 - 3.5.1 Colon system
 - 3.5.2 Outdoor system
 - 3.6 Diseases and vices**

3.6.1 Common diseases: Snuffles, Coccidiosis, ear canker, mucoid enteritis.

3.6.2 Prevention of common diseases

3.6.3 Vices: Fur chewing, Cannibalism in breeding does

3.6.4 Rabbit meat marketing

Practical – (Elaborate)

- a. Introduction to the poultry unit of the college farm
- b. Visit one of the hatcheries/poultry farms
- c. Incubation and candling
- d. Cleaning and disinfection of the brooder
- e. Vaccination
- f. Culling of unprofitable birds
- g. Slaughter and dressing of birds
- h. Recording of farm data
- i. Introduction to the pig unit of the college farm
- j. Selection of breeding stock
- k. Cleaning and disinfection of the pen
- l. Washing of the sow
- m. Iron injection
- n. Teeth clipping
- o. Tail docking
- p. Navel Cutting
- q. Identification Methods
- r. Use of ACS pig planner
- s. Visit to a rabbitry
- t. Handling Rabbits
- u. Breeding and test mating
- v. Feeds

- | | |
|----|-----------------------------------|
| w. | Sexing |
| x. | Slaughter, dressing and marketing |
| y. | Preparation for kindling |

Prescribed Textbooks:

1. Battaglia, RA 2007, *Handbook of Livestock Management*, Pearson Education Inc, 4th Edition ,Upper Saddle River, New Jersey 07458, ISBN 0-13-118933-6
2. Gillespie, RJ 1989, *Modern livestock and Poultry Production*, Delmar Publishers Inc, 4th Edition, USA, ISBN O-8273-3277-7

Recommended Textbook

1. Holness, DH 2005, *Tropical Agriculturist-Pigs*, CTA Macmillan, 6700 AJ Wageningen, The Netherlands, ISBN 0-333-79148-7.

**COURSE TITLE: APPLIED EXPERIMENTAL DESIGN AND ANALYSIS FOR
AGRICULTURAL RESEARCH**

COURSE CODE : ANS 351

PRE-REQUISITES : BIOMETRY

Aim

This course aims at quipping students with practical aspects of experimental design and analysis in research projects.

Learning Outcomes

Upon successful completion of this course, the students should be able to:

1. Explain the principles, models and strategies commonly used in experimental design and data analysis, and be comfortable planning and analyzing experiments.
2. Outline the experimental research design process;
3. Develop research proposal and report
4. Demonstrate appropriate referencing skills;

Course outline

1. Basic principles of experimental design;
2. Randomization;
3. Completely randomized design;
4. Paired design;
5. Randomized blocks,
6. Latin Squares,
7. Greco-Latin Squares and related designs;
8. Factorial design;
9. Blocking in factorial design
 - 9.1 2k factorial design;
 - 9.2 Extension of 2k factorials;
 - 9.3 Blocking and confounding in 2k factorials;

- 9.4 Partial confounding;
- 9.5 Fractional factorial designs;
- 9.6 Blocking in fractional factorials;
- 9.7 Nested and split-plot designs;
- 9.8 Replicated and un-replicated designs;
- 9.9 Regression, ANOVA, and follow-up analysis;
- 9.10 Power calculation;
- 9.11 Sample size determination;
- 9.12 Relative efficiency;
- 9.13 Response surface;
- 9.14 Random effects mode

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours tutorials

Assessment

Continuous Assessment	40
	%
1 Assignment	10%
2 Tests	10%
Research project	20%
Final Examination	60 %

Prescribed Readings

1. Montgomery, D. C. (2013). *Design and Analysis of Experiments*. (8th Ed.).
2. Youdeowei, A., Stapleton, P., and Obubo, R., (Eds.). (2012). *Scientific Writing for Agricultural Research Scientists: A Training Resource Manual*, Wageningen, The Netherlands CTA.

Recommended Reading

1. Montgomery, D. C. (2017). *Design and Analysis of Experiments*. (9th Ed.). Wiley.

COURSE TITLE : FIELD ATTACHMENT II

COURSE CODE : ANS 361

PRE-REQUISITE : FIELD ATTACHMENT I

Aim

To strengthen the practical knowledge of students and their involvement in various horticultural projects

Learning outcomes

Upon successful completion of this course, the students should be able to:

5. To provide the student with practical on-the-job experiences in an extension service provider
6. Submit a written report of their activities and that of the field supervisor
7. Provide information of the activities in case the school intends to visit students in the field.
8. Intellectually and emotionally, and to recognize the strength of individual and collective difference within the organisation.

Course content

Practical

- Placement of students at various public and private organizations providing agricultural extension services to farmers
- Study, discussion and their practical involvement in ongoing extension programs/projects
- Performance of practical managerial duties or practical demonstration of important operations in the concerned programs
- Meet an employer's attendance, punctuality and reliability expectations
- Communicate effectively with others in the workforce
- Submission of report and oral presentation at the end of the semester

Assessment

Field attachment experience composite results shall be out of:

e) Student report	30%
f) Portfolio/File	10%
g) Mentor's observation mark	40%
h) Lecturer's observation mark	20%
Total	100%

COURSE TITLE : ANIMAL HEALTH

COURSE CODE : ANS 312

PRE REQUISITES : ANIMAL PRODUCTION

Aim: To equip students with knowledge and skills in basic animal health practices.

Learning Outcomes

Upon completion of the course students will be able to:

1. Identify sick animals from the herd.
2. Explain the causes of diseases
3. Distinguish the different disease states
4. Explain various routes of disease transmission
5. Illustrate the different disease mechanisms and processes
6. Elaborate various disease methods
7. Carry out clinical examination of animals.
8. Describe various aids of disease diagnosis.
9. Describe the various disease control methods.
10. List the various causes of poisoning in farm animals
11. Recognize causes of disease in sheep, goat, cattle, pigs, and piglets and poultry

Course Outline

1.0 **Health and Disease**

- 1.1 Definition of health
- 1.2 Indicators of healthy status
- 1.3 Deviations from healthy status
- 1.4 Effects of disease on livestock production
- 1.5 Disease predisposing factors
 - 1.5.1 Environmental factors
 - 1.5.2 Host factors
- 2.0 **Causes of Diseases**
- 2.1 Living organisms
 - 2.1.1 Microscopic microorganisms
 - 2.1.2 Macroscopic microorganisms
- 2.2 Other factors
 - 2.2.1 Physical
 - 2.2.2 Chemical
 - 2.2.3 Metabolic
 - 2.2.4 Genetic
 - 2.2.5 Physiological
 - 2.2.6 Nutritional
 - 2.2.7 Hereditary
 - 2.2.8 Social
- 3.0 **Disease Status**
- 3.1 Hyperthermia/pyrexia
- 3.2 Hypothermia
- 3.3 Toxemia
- 3.4 Septicemia
- 3.5 Allergy and anaphylaxis
- 4.0 **Disease Transmission Routes**
- 4.1 Oral
- 4.2 Respiratory

- 4.3 Venereal
- 4.4 Contact
- 4.5 Vectors and formats
- 4.6 Wounds

- 5.0 **Defence Mechanisms and Disease Process**
- 5.1 Resistance
- 5.2 First line of defence
 - 5.2.1 Skin
 - 5.2.2 Mucosal surfaces (Gastro intestinal tract, respiratory tract, eyes, vagina)

- 6.0 **The lymphatic system**
- 6.1 Second line of defence
 - 6.1.1 Inflammation
 - 6.1.2 Abscess formation
- 6.2 Third line of defence

- 7.0 **Clinical Examination**
- 7.1 Preliminary examination
 - 7.1.1 History taking
 - 7.1.2 Inspection
- 7.2 Physical examination

- 8.0 **Ancillary procedures and tests**
- 8.1 Bacteriological
- 8.2 Parasitological
- 8.3 Biochemistry
- 8.4 Histology
- 8.5 Radiology
- 8.6 Biological

- 8.7 Serological
- 8.8 Physical
- 8.9 Preliminary examination

- 9.0 **Disease Control Methods**
- 9.1 Quarantine
- 9.2 Creation of unfavourable habitats
 - 9.2.1 Tolerance
 - 9.2.2 Resistance
 - 9.2.3 Control of vectors
- 9.3 Chemical and biological prophylaxis
 - 9.3.1 Chemical prophylaxis
 - 9.3.1.1 Use of antibiotics in feed
 - 9.3.1.2 Use of coccidiostats
 - 9.3.1.3 Use of samorin in trypanosomosis control
 - 9.3.2 Biological prophylaxis
 - 9.3.2.1 Vaccination
 - 9.3.2.2 Use of antiserum, immune serum or hyper immune serum
- 9.4 Disinfection/sterilization/biosecurity

- 10.0 **Internal Parasites:** problems associated with internal parasites: clinical signs, diagnosis, and treatment and control measures adopted in:
- 10.1 helminths
 - 10.1.1 Cestodes
 - 10.1.2 Nematodes
- 10.2 Protozoa

- 11.0 **Ticks and Tick-borne Diseases**

11.1 Life cycles of common ticks in Zambia.

11.1.1 One host tick

11.1.2 Two host ticks

11.1.3 Three host ticks

11.2 Principles and practice of tick control.

11.2.1 Plunge dip

11.2.2 Spray race (stationery/mobile)

11.2.3 Knapsack/Hand spray

11.2.4 Pour-on

11.2.5 Hand dressing

11.2.6 Other methods: collars, impregnated tags

11.3 **Tick-borne diseases**

11.3.1 Cause, mode of transmission, clinical signs and symptoms, diagnosis, treatment, post-mortem findings and control of the common tick-borne diseases:

11.3.2 Anaplasmosis

11.3.3 Babesiosis

11.3.4 Theileriosis

11.3.5 Rickettsiosis

11.3.6 Tick toxicosis

12.0 **Trypanosomosis:** cause, mode of transmission, zoonotic potential, clinical signs and symptoms, diagnosis, treatment and control.

13.0 **Toxicology:** common sources, routine preventive precautions, clinical signs and symptoms, and treatment of some common poisons:

13.1 Urea

13.2 Cyanide

13.3 Organophosphorus compounds

13.4 Chlorinated hydrocarbons

- 13.5 Warfarin poisoning
- 13.6 Salt (sodium chloride)
- 13.7 Strychnine
- 13.8 Arsenic
- 13.9 Lead
- 13.10 mycotoxins

- 14.0 **Wounds**
- 14.1 Types of wounds
- 14.2 Wound Healing
 - 14.2.1 Wound management
 - 14.2.2 Special wounds
 - 14.2.3 Fractures
 - 14.2.4 Teat wounds
 - 14.2.5 Eye wounds

- 15.0 **Diseases of sheep and goats**
- 15.1 Scheduled diseases
 - 15.1.1 Clostridial diseases
 - 15.1.2 2 Infectious abortion
 - 15.1.3 Microbial diseases
- 15.2 Viral diseases
 - 15.2.1 Nairobi sheep disease
 - 15.2.2 Blue tongue
 - 15.2.3 Pseudo-pox
- 15.3 Parasitic gastro enteritis
 - 15.3.1 Tapeworms
 - 15.3.2 Flukes
- 15.4 External parasites
 - 15.4.1 Ticks, lice and fleas

15.4.2 Nasal flies

15.4.3 Blow and screw worms

16.0 Diseases of cattle and calves

16.1 Calf diseases

16.1.1 Pneumonia

16.1.2 Enteritis (dietary, coliform, salmonellosis, coccidian)

16.1.3 Navel ill/joint ill

16.1.4 Calf diphtheria

16.1.5 Sweating sickness

16.1.6 Infectious ophthalmia

16.2 Cattle diseases

16.2.1 Mastitis

16.2.2 Blackleg

16.2.3 Tuberculosis

16.2.4 Foot rot

16.2.5 Contagious abortion

16.2.6 Ephemeral fever

16.2.7 Foot and mouth disease

16.2.8 Bloat

16.2.9 Acidosis

16.2.10 Hypomagnesaemia

16.2.11 Hypocalcaemia

16.2.12 Hypocalcaemia

17.0 Diseases of pigs and piglets

17.1 Piglet diseases and conditions

17.1.1 Scours

17.1.2 Hypocalc
aemia

17.1.3 Anaemia

17.1.4 Virus
pneumonia

17.2 Pig diseases

17.2.1 Mastitis

17.2.2 Metritis

17.2.3 Agalactia

17.2.4 Pasteurellosis

17.2.5 Polyarthrititis

17.2.6 Erysipelas

17.2.7 African swine
fever

17.2.8 Tetanus

17.2.9 Bowel oedema

17.2.10 Swine dysentery

17.2.11 Salmonellosis

17.2.12 Colibacillosis

17.2.13 Foot rot

17.2.14 Avitaminosis A

18.0 **Diseases of poultry**

18.1 Common poultry diseases

18.1.1 Newcastle disease

18.1.2 Avian influenza (bird flu)

18.1.3 Fowl pox

18.1.4 Avian salmonellosis

18.1.5 Fowl Cholera

18.1.6 Avian leucosis

18.1.7 Marek's disease

18.1.8 Gumboro

18.1.9 Coccidiosis

18.1.10 Aspergillosis

18.2 General disease control of poultry diseases

18.2.1 Biosecurity

18.2.2 Vaccination

18.2.3 Parasite control

19.0 **Skin diseases**

19.1 Mange

19.2 Ringworm

19.3 Streptothricosis (senkobo)

19.4 Urticaria

19.5 Eczema

19.6 Photosensitization

19.7 Lumpy skin disease

Suggested Practical

1.0 Restraint and handling techniques of different animals (cattle, sheep, Goats, pigs)

2.0 Identification of animal handling devices

3.0 Clinical examination

3.1 History taking

3.2 Physical examination

3.2.1 Temperature taking

3.2.2 Pulse measurement

3.2.3 Respiratory rate measurement

3.2.4 Heart rate measurement

3.2.5 Rumination rate measurement

3.2.6 Visible mucous membranes

3.3 Management plan

4.0 Identification of palpable lymph nodes

5.0 Identification of microscopic and macroscopic microorganisms

5.1 Bacteria

5.2 Fungi

5.3 Rickettsia

5.4 Internal parasites

5.4.1 Helminthes

5.4.2 Protozoa

6.0 Collection of blood samples from different animals

6.1 Preparation of blood smears and examination

6.2 Thick smears

6.3 Thin smears

7.0 Performing of routine disease control methods

7.1 Tick control

7.1.1 Dip tank and spray race
calibration

7.1.2 Recharging/replenishing

7.1.3 Use of hand spray and hand
dressing

7.1.4 Use of pour ons and other
methods

7.2 Deworming

7.3 Biosecurity

7.4 Vaccinations of animals

7.5 Vaccination of farm animals

7.5.1 Anthrax

7.5.2 Blackleg

7.5.3 Hemorrhagic septicemia

7.5.4 Lumpy skin disease

7.5.5 Foot and Mouth Disease (FMD)

7.5.6 Rabies

7.5.7 Newcastle disease

7.5.8 Contagious abortion

7.5.9 Clostridial diseases

8.0 Branding and ear tagging

9.0 Management of bloat

10.0 Post mortem examination

11.0 Management of common ailments

12.0 Farm visits and excursions

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours practicals

Assessment

Continuous Assessment 40 %

Practicals 30%

Test 10%

Final Examination 60 %

Theory examination 20%

Practicals 40%

Prescribed Readings

1. Blood, D. C. (1995). *Veterinary Medicine*. (8th Ed.). English Language Book Society, Baillière Tindall Ltd. ISBN: 0 7020 13168.
2. Cullen, P. T. (1991). *Farm Animal Health a Practical Guide*. Pergamon Press, USA.
ISBN: 0-08-037500-6.
3. Fraser, C. M., J. A., Bergeron, A., Mays, and Aiello, S. E. (1991). *The Merck Veterinary Manual*. (7th Ed.). New Jersey: Merck & Co. Inc. ISBN: 911910-55-7.

Recommended Readings

1. Chandler, E. A., Thompson, D. J., Sutton, J. B. and Price, C. J. (1991). *Canine Medicine and Therapeutics*. (3rd Ed.). London: Blackwell Scientific Publishers.

2. Robert, S. H. (1992). *Oxford Concise Veterinary Dictionary*. New Delhi, India: CBS Publishers & Distributors. ISBN: 81 -239-0137-2.
3. Seifert, H. S. H. (1996). *Tropical Animal Health*. (1st Ed.). CTA, Kluwer Academic Publishers, Dordrecht. The Netherlands. ISBN:13: 978-0792338215.
4. Battaglia, R. A. (2007). *Handbook of Livestock Management*. (4th Ed.). Pearson Education, Inc. ISBN: 0-13-118933-6

COURSE TITLE : POULTRY PRODUCTION

COURSE CODE : ANS 322

PRE-REQUISITE : NONE

Aim

To provide students with knowledge and skills of commercial poultry management practices.

Learning outcomes

Upon completion of the course, students should be able to:

- 1) Explain the state and limitations of the poultry industry in Zambia.
- 2) Perform management operations involved in commercial broiler poultry production.
- 3) Explain the state and limitations of the layer and egg industry in Zambia.
- 4) Perform management operations involved in egg production.
- 5) Demonstrate knowledge of village chicken production

Course content

1. Origins of Common Poultry Species and Their Domestication
2. Poultry Keeping and Evolution of the Modern Industry
 - Traditional poultry keeping
 - The modern poultry industry
3. Hatchery Management in the Broiler Industry
 - Hatching egg selection and handling
 - Incubation and hatching
 - Handling day-old chicks
 - Sanitation and disease control
 - Record keeping
4. Management of Broiler Enterprises
 - Housing and equipment
 - Brooding
 - Feeding and watering
 - Lighting
 - Health management of growing birds
 - Security arrangements

- Record keeping
5. Marketing of Broilers - Handling of birds
 - Market arrangements
 - Transportation
 6. Egg Nutritional Value and Nutritional Misconceptions
 7. The Parent Stock of the Layer Industry
 - Housing and equipment
 - Feeding and watering
 - Lighting
 - Mating
 - Egg collection and grading
 - Fumigation and handling
 - Health management
 - Security considerations
 - Record keeping
 8. Management of the Layer Enterprise
 - Managing pullets: housing and equipment, feeding and watering, lighting, health management, record keeping.
 - Managing layers: housing and equipment, feeding and watering, lighting, egg collection, handling and grading, health management, record keeping.
 9. Marketing of Eggs
 - Market arrangements
 - Packaging
 - Transportation
 10. Culling of Layers
 11. Village Chicken Production
 - Definition of a village chicken
 - Production systems: traditional method (range), semi-intensive, commercial.
 12. Selection and Breeding Programmes Chicken types

- Consideration of traits for selection
- Breeding programmes among local chickens

13. Management of Breeding Stock

- Housing and equipment
- Male: Female ratios
- Placement of nests for egg laying
- Feeding: supplementation
- Consideration of use of commercial feeds
- Watering
- Security considerations: animals of prey, reptiles, theft

14. Management of Chicks and growing birds

- Housing and equipment
- Weaning
- Feeding: provision of rangeland
- Feeding: supplementation
- Consideration of use of commercial feeds
- Watering
- Security considerations: animals of prey, reptiles, theft

15. Management of Reproduction

- Age at point of lay
- Selection of cocks and age of maturity

16. Health Management

- Major diseases of village chickens
- Prevention of diseases
- Treatment of diseases
- General environment for keeping village chickens
- Health management of nests and eggs
- Health management of brooders

17. Hatching of Eggs

- Management of chicks on day one
- Management of unhatched eggs

18. Marketing of Village Chickens

- Handling of birds
- Market arrangements
- Transportation

19. Culling of breeding stock

Assessment

2 Assignments	40%
Practicals	30%
Test	10%
Final Examination	60%

Prescribed Textbooks

- 1) Sapkota, D, Narahari, D and Mahanta, J.D. 2015. **Avian (Poultry) production**. New India Publishing Agency. India.
- 2) Card, L.E. 2016. **Poultry Production**. 9th edition. Norton Greek Press, US.
- 3) Dagher, N.J. 2008. **Poultry Production in Hot Climates**. 2nd Edition. CAB Publishing, UK.
- 4) Oluyemi J.A and F. A. Roberts. 2008. **Poultry Production in Warm Wet Climates**. McMillan Press, London. ISBN: 0333253124, 9780333253120.
- 5) Musukwa M.N. 2006. **Commercial Production of Village Chickens**. ISBN 9982-56-0158

Recommended Textbooks

1. Say R. R. 1987. **Manual of Poultry Production in the Tropics**. CAB International. ISBN: 211084499X, 9782110844996.
2. Payne, W.J.A. and Wilson, R.T. 1999. **An Introduction to Animal Husbandry in the Tropics**. 5th Edition. Wiley-Blackwell. ISBN: 0632041935, 9780632041930
3. Schaibe, P.J. and Patrick, H. 1983. **Poultry: Feeds and Nutrition**. 2nd Edition. Avi Publishing Company, Westport, Connecticut. ISBN: 0870553496, 9780870553493

4. Schaible P. J. 1970. *Poultry: Feeds and Nutrition*. The Avi Publishing Company, Westport, Connecticut. ISBN: 0870553054, 9780870553059.

3.9 COURSE TITLE : **ANIMAL GROWTH AND DEVELOPMENT**
COURSE CODE : **ANS 332**

PRE-REQUISITES : **FUNDAMENTALS OF ANIMAL
PHYSIOLOGY AND ANATOMY**

Aim

The aim of this course is for students to understand the fundamentals of animal growth and development from a single cell to an organism.

Learning Outcomes

Upon successful completion of this course, students should be able to:

1. Describe foetal development;
2. Outline the factors that can have a lifelong influence on the newborn animal;
3. Describe the process of differentiation and the growth of bone, muscle and adipose tissue;
4. Explain the concept of nutrient partitioning and the control of body composition; and
5. Analyse the ways in which animal growth and composition are manipulated in the interests of livestock production or animal health.

Course outline

1. Cells and principles of cell growth:
 - 1.1. Cell structure
 - 1.2. Mitosis
 - 1.3. Origins of individual variation
 - 1.4. Cell signaling
2. Embryo development
 - 2.2 Zygote to embryo
 - 2.3 Pre-implantation embryo

- 2.4 Implantation
- 2.5 Early embryogenesis
- 3. Basic structure, development and function of selected tissues
 - 3.1. Muscle
 - 3.1.1 Prenatal development
 - 3.1.2 Structural organization
 - 3.1.3 Pathologies
 - 3.1.4 Excitation
 - 3.1.5 Contraction coupling
 - 3.1.6 Muscle fiber types & metabolism
 - 3.1.7 Postnatal growth
 - 3.2. Connective tissue
 - 3.2.1 general structure and types
 - 3.2.2 cartilage
 - 3.3. Bone as connective tissue type
 - 3.3.1 Types
 - 3.3.2 Structure and anatomy
 - 3.3.3 prenatal development
 - 3.4. Adipose tissue
 - 3.4.1 Types
 - 3.4.2 Structure and anatomy
 - 3.4.3 Prenatal development
 - 3.4.4 Regulation
- 4. Hormonal influences on growth
 - 4.1. General characteristics of hormones
 - 4.2. Growth hormone and IGF-1
 - 4.3. Sex hormones
 - 4.4. Insulin and Glucagon
 - 4.5. Leptin
 - 4.6. Catecholamines

- 4.7. Glucocorticoids
- 4.8. Thyroid hormones
- 5. Whole animal development
 - 5.1. Phases of the growth curve
 - 5.2. Models of growth
 - 5.3. Types of growth curves
 - 5.4. Components of whole-body growth
 - 5.5. Allometric growth
 - 5.6. Types of growth curves
 - 5.7. Whole body composition
 - 5.8. Types of growth curves
 - 5.9. Chemical composition of body tissues
- 6. Genetic factors affecting growth
 - 6.1. Species effects on growth
 - 6.2. Breed effects on growth
 - 6.3. Sex effects on growth
- 7. Environmental factors affecting growth
 - 7.1. Nutritional effects on growth
 - 7.2. Microbial effects on growth
 - 7.3. Stress effects on growth
 - 7.4. Physical activity and growth

Duration: 15 weeks

Contact Hours

3 hours lectures per week

1 hour tutorials per week

Assessment

Continuous Assessment	40 %
2 Assignments	10%
2 Tests	30%

Final Examination

60 %

Prescribed Readings

2. Lawrence, Fowler and Novakofski. (2012). *Growth of Farm Animals*. (3rd Ed.). ISBN: 13: 978-1-84593-558-0 (paperback); CABI Cambridge, MA
3. Silbernagl and Despopoulos. (2008). *Color Atlas of Physiology*. (6th Ed.). ISBN: 13: 978-3135450063.

Recommended Reading

1. Gerrard and Grant. (2002). *Principles of Animal Growth and Development*. Dubuque, Iowa: Kendall Hunt Publishing. ISBN: 13: 978-0-7575-2986-3

3.10 COURSE TITLE : APPLIED ANIMAL NUTRITION

COURSE CODE : ANS 342

PRE-REQUISITES : PRINCIPLES OF ANIMAL NUTRITION

Aim

The aim of this course is to provide students with knowledge and skills on the science and practice of animal nutrition.

Learning Outcomes

Upon successful completion of the course students should be able to;

1. Evaluate food nutrients
2. Explain food utilization by the animal
3. Determine nutrient requirements of domestic animals for different physiological needs
4. Recognize consequences of poor nutrition
5. Make rations for different classes of animals

Course Outline

1.0 Introduction

- 1.1** Objectives of feeding
- 1.2** Utilization of feed
 - 1.2.1 Digestion: Monogastric and Ruminants
 - 1.2.2 Metabolism
- 1.3** Types of feed available to livestock

- 2.0 Component of feeds**
- 2.1** Carbohydrates
 - 2.1.1 Definition
 - 2.1.2 Chemical composition
 - 2.1.3 Classification
- 2.2 Energy
 - 2.2.1 Definition
 - 2.2.2 Sources
 - 2.2.3 Metabolism
 - 2.2.4 Energy value of livestock feeds
- 2.3 Fats and Oils
 - 2.3.1 Definition: Fats ; oils
 - 2.3.2 Formation
- 2.4 Characteristics/properties of fats and oils
- 2.5 Fatty acids
 - 2.5.1 Essential fatty acids
 - 2.5.2 Saturated unsaturated fatty acids
 - 2.5.3 Storage of fats
- 2.6 Proteins
 - 2.6.1 Definition
 - 2.6.2 Chemical composition
 - 2.6.3 Formation
 - 2.6.4 Properties
 - 2.6.5 Amino acids

2.6.5.1 Definitions

2.6.5.2 Characteristics

2.6.5.3 Groups: essential: non-essential

3.0 Methods of determining nitrogen content of feeds

3.1.1 Apparent Biological value

3.1.2 True Biological value

3.2 Non-protein nitrogenous (NPN) compounds

3.2.1 Definition

3.2.2 Groups

3.2.3 Utilisation by ruminants

3.2.3.1 Sources of nitrogen

3.2.3.2 Factors influencing level of ammonia entering the bloodstream

3.2.3.3 Recommendation on the use of urea

3.2.3.4 Ways in which NPN can be fed to livestock

3.3 Important sources of protein for livestock

3.3.1 Plant sources

3.3.2 Animal/marine sources

4.0 Minerals

4.1 Major elements

4.1.1 Functions

4.1.2 Sources

4.1.3 Deficiencies

4.1.4 Imbalances

5.0 Vitamins

5.1 Groups

5.1.1 Fat-soluble

5.1.2 Water-soluble

5.2 Roles

5.3 Sources

5.4 Deficiencies

6.0 **Water**

6.1 Functions

6.2 Sources

7.0 **Proximate analysis of Feeds**

7.1 Moisture

7.2 Crude protein

7.3 Ether Extract

7.4 Crude fiber

7.5 NFE

8.0 Modern Analytical Methods

8.1 Peter Van Soest method

8.1.1 Neutral Detergent Fibre

8.1.2 Acid Detergent Fibre

8.1.3 Modified Acid Detergent Fibre

8.2 Non-Starch Polysaccharides

8.3 Atomic Absorption Spectroscopy

8.4 Flame Photometry

8.5 Gas Liquid Chromatography

8.6 Nuclear Magnetic Resonance Spectroscopy

9.0 Ration formulation

9.1 Guidelines

9.1.1 Complete poultry and pig rations

9.1.2 Supplements for cattle

9.2 Methods of calculation

9.2.1 Pearson square

9.2.2 simultaneous algebraic equations

9.2.3 trial

10.0 Individual animal bases

11.0 Evaluation of feeds

11.1 Protein evaluation

11.1.1 Crude protein (CP)

11.1.2 Digestible crude protein

11.1.3 Non-protein nitrogen

11.2 Energy evaluation

11.2.1 Gross energy(GE)

11.2.2 Digestible energy(DE)

11.2.3 Total digestible nutrients(TDN)

11.2.4 Metabolisable energy(ME)

11.2.5 Starch equivalent(SE)

11.3 Digestibility

11.3.1 Apparent digestibility

11.3.2 True digestibility

11.3.3 Digestive co-efficient

11.3.4 Digestibility of different feed

fractions

11.3.5 Factors affecting the digestibility

of feedstuffs **Suggested Practicals**

1.0 Feedstuffs

i. Classification and Nutritive value

2.0 Feeding standards

3.0 Proximate analysis of feedstuffs

i. Feed fractions (Weende scheme)

ii. Bases for analysis

1. as-fed or fresh or wet
2. air-dry
3. moisture free

4.0 Ration formulation

i. Guidelines ii.

Methods of calculation

1. Pearson square
2. Trial and Error
3. simultaneous algebraic equations
4. Individual animal bases

5.0 Visit to a feed manufacturer

Duration: 15 weeks

Contact Hours

3 hours lectures per week

Assessment

Continuous Assessment	40 %
2 Assignment	30%
1 Test	10%
Final Examination	60 %

Prescribed Reading

1. Gillespie, RJ 1989, *Modern livestock and Poultry Production*, Delmar Publishers Inc, 4th Edition, USA, ISBN 0-8273-3277-7

Recommended Reading

McDonald, P, Edwards, RA & Greenhalgh, JFD 1966, *Animal Nutrition*, 5th Edition, Longman Singapore Publishers Pte Ltd, ISBN 0-582-26504-5

COURSE TITLE : PIG PRODUCTION

COURSE CODE : ANS 352

PRE-REQUISITE : ANIMAL PHYSIOLOGY AND ANATOMY

Aim

The main aim of this course is for students understand and apply the principles of animal production thereby, manage and advise farmers on aspects of pig production

Course outline

- 1.1 Definition of terms
- 1.2 Origin and domestication of pigs
 - 1.2.1 Pig production in Zambia
 - 1.2.2 Future of the pig industry in Zambia
 - 1.2.3 Types and breeds of pigs
- 1.3 Establishing the herd
- 1.4 Pig buildings
- 1.5 Breeding
 - 1.5.1 The estrus cycle
 - 1.5.2 Reproductive cycle
 - 1.5.3 Heat detection
 - 1.5.4 Mating
 - 1.5.5 Fertilization
 - 1.5.6 Gestation and pregnancy diagnosis
 - 1.5.7 Farrowing
- 1.6 Breeding records
 - 1.6.1 Selection of breeding stock
 - 1.6.2 Performance and progeny testing
 - 1.6.3 Artificial insemination
- 1.7 Management
 - 1.7.1 Breeding management
 - 1.7.2 Preparation for farrowing
 - 1.7.3 Routine tasks

- 1.7.4 Rearing pigs up to weaning and slaughter age
- 1.7.5 Records as an aid to management; selection of breeding stock by visual assessment
- 1.7.6 Management of sow and gilt
- 1.8 Systems of management
 - 1.8.1 Peasant or village keeping
 - 1.8.2 Intensive; extensive, semi- intensive
- 1.9 Feeding
 - 1.9.1 Nutritive needs of pigs
 - 1.9.1.1 Energy 1.9.1.2 Protein
 - 1.9.1.3 Minerals
 - 1.9.1.4 Vitamins 1.9.1.5 Water
 - 1.9.2 Feed for pigs
 - 1.9.2.1 Concentrates 1.9.2.2 Feed consumption
 - 1.9.2.3 Feeding different classes of pigs
- 1.10 Slaughter and Marketing of pigs
 - 1.10.1 Killing and dressing 1.10.2 Marketing of pork
- 1.11 Diseases and their control
 - 1.11.1 Common diseases and their management
(Diseases to Come Out). (Vaccine handling)
 - 1.11.2 Disease preventive measures

Assessment	40%
Continuous assignment	10%
Tests	20%
Final examination	60%

Prescribed Readings

1. Holnes, D.H. (2005). *Pigs* (Revised Ed). *The Tropical Agriculturalist*, CTA MacMillan, London.

2. Muys, D. and Westenbrink, G. (2002). *Pig Husbandry in the Tropics*. CTA MacMillan, London.

Recommended Readings

1. Johan van 't Klooster Arie Wingelaar (2011). Pig farming in the tropics From free range to small-scale intensive production systems. Agromisa Foundation and CTA, Wageningen, ISBN Agromisa: 978-90-8573-126-9 ISBN CTA: 97892-9081-440-5
2. Serres H. (Author), Julian Wiseman (Translator). 1992. Manual of Pig Production in the Tropics First Edition. Oxford University Press; First edition
ISBN-10 : 0851987842 ISBN-13 : 978-0851987842

Year Four:

SEMESTER I		SEMESTER II	
ANS411	Animal Breeding	AEX412	Agricultural Extension and Rural Sociology
ANS421	Pasture Management and Forage Production	ANS422	Range Management
ANS431	Beef Production	ANS432	Dairy Production
ANS441	Aquaculture Production And Management	ANS442	Animal Products and Byproducts
ANS451	Applied Animal Reproduction	ANS452	Research Project

COURSE TITLE : ANIMAL BREEDING

COURSE CODE : ANS 411

PRE-REQUISITES : ANIMAL GENETICS

Aim

To equip students with some basic understanding of modern techniques of genetic evaluation of farm animals, and how genetic differences between individual animals as well as breed differences are utilized to improve animal characteristics in modern production systems

Learning Outcomes

Upon successful completion of this course the students should be able to:

1. Gain a clear understanding of principles of animal genetics and modern techniques of genetic evaluation.
2. Apply genetic principles and techniques to improve the economic value and performance of farm animals
3. Critically analyze and apply some of the animal improvement tools that are used notwithstanding their limitations.
4. Evaluate commonly used animal breeding programs and practices and clearly enunciate their relevance, using the correct animal breeding terminology.

Course outline

- 1.0 Breeds of farm animals and breed conservation
 - 1.1 Common farm animals
 - 1.2 Conservation of animal genetic resource
2. Genetic improvement-systems approach to genetic improvement
3. Mendelian principle of inheritance
 - 3.1 Mendel's laws and gene action

- 3.2 Type of gene action at a single locus and at multiple loci
- 3.3 Sex related inheritance and other forms of inheritance
- 3.4 Mendelian genetics detrimental and lethal conditions of animals
- 4. Genetic differences
 - 4.1 Differences in chromosomal morphology
 - 4.2 Nucleotide bases as the genetic code found on the chromosomes.
 - 4.3 Classification of DNA sequences of chromosomes in the mammalian genome.
 - 4.4 Functional and pseudo gene sequences, Genome mapping
- 5. Genetic architect of a trait
 - 5.1 Gene interactions to produce specific phenotypes
- 6. Population genetics
 - 6.1 Gene and genotype frequencies.
 - 6.2 The Hardy-Weinberg law and how gene and genotypic frequencies change at a single or at multiple loci to re-establish equilibrium.
 - 6.3 The Hardy-Weinberg law and sex-linked loci.
 - 6.4 The effect of distance between linked loci on the disequilibrium value and recombination frequency
 - 6.5 Forces that change gene frequency
- 7. Quantitative genetics
- 8. Selection
- 9. Cross breeding

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours tutorials

Assessment

Continuous Assessment 40 %

2 Assignments	10%
2 Tests	10%
Practical	20%
Final Examination	60 %

Prescribed Reading

2. Nicholas, F. W. (2000). *Introduction to Veterinary Genetics*. Oxford University Press.
3. Gupta, P. K. (2004). Cytology, Genetics and evolution. Rastogi Publications, Meerut. (Hindi Edition).
4. Klug, W. W. and Cummings, M. R. (2005). Concepts of genetics Pearson Education (Singapore) pvt. Ltd., Indian Branch, Pratap Ganj, New Delhi.

Recommended Reading

1. Bourdon, R. M. (2000). *Understanding Animal Breeding*. (2nd Ed.). Prentice Hall.
2. Strickberger, M. W. (2001). *Genetics*. Prentice Hall of india. Pvt. Ltd., New Delhi.

4.2 COURSE TITLE: PASTURE MANAGEMENT AND FORAGE PRODUCTION

COURSE CODE : ANS 421

PRE-REQUISITES : FIELD CROP PRODUCTION

Aim

This course aims to build the knowledge of the student to choose the most appropriate plant species for a pasture, to suit the property and the environment, and optimize the needs of livestock.

Learning Outcomes

Upon successful completion of this course, the students should be able to:

1. Identify characteristics of a pasture plant which are relevant to livestock;
2. Determine criteria for selecting appropriate varieties of plants for a pasture;
3. Evaluate the potential of given sites for pasture development programs;
4. Explain the procedures used in managing the establishment of pasture;
5. Explain the techniques used in managing pasture which is already been established;
6. Assess the commercial and nutritional value of pasture species in the context of farm;
7. Determine appropriate ways of managing feed stock; and
8. Develop an appropriate work program for the management of a pasture by a farmer.

Course outline

1. Introduction to Pastures
 - 1.1. Pasture improvement

- 1.2. Choosing a pasture mix
- 1.3. Seed coating and variety selection
- 1.4. Sustainability
2. The pasture plant
 - 2.1 The grass plant
 - 2.2 Growth and development
 - 2.3 Phases of development
 - 2.4 Annual and perennial grasses
 - 2.5 Carbohydrate sinks
 - 2.6 The physiology of grasses
 - 2.7 The structure of grasses
 - 2.8 Growth habits
 - 2.9 Legumes
3. Pasture varieties
 - 3.1 Introduction to common pasture grasses
 - 3.2 Identifying grasses
 - 3.3 Legumes
 - 3.4 The importance of legumes in pasture
 - 3.5 Nitrogen fixation in legumes
 - 3.6 The rhizobium bacteria
 - 3.7 Common legumes
 - 3.8 Grasses to grow with clovers
4. Site considerations and management
 - 4.1 Managing pastures
 - 4.2 Choosing the correct site for a pasture
 - 4.3 Choosing the correct seed mix
 - 4.4 Seed quality
5. Establishing new pastures
 - 5.1 Land preparation

- 5.2 Planting methods
- 5.3 Germination
- 5.4 Weed control
- 5.5 Seeders
- 5.6 Grazing new pastures
- 6. Managing existing pastures
 - 6.1 Native grasses versus pastures
 - 6.2 Carrying capacity of native grasses
 - 6.3 Stocking rate of native grass areas
 - 6.4 Establishment of the native grasslands
 - 6.5 Developing grasslands
 - 6.6 How grasslands deteriorate
 - 6.7 Factors promoting succession or retrogression
 - 6.8 Limiting factors and terminal plant communities
 - 6.9 Allogenic and autogenic factors
- 7. Managing stock on pasture
 - 7.1 Factors affecting food intake by animals
 - 7.1.1 Animal factors
 - 7.1.2 Feed factors
 - 7.1.3 Grazing factors
 - 7.2 Grazing behavior
 - 7.3 Complementary grazing
 - 7.4 Rank order of dominance
 - 7.5 Selective grazing
 - 7.6 Grazing time
 - 7.7 Ruminating time
 - 7.8 Herd group behavior
 - 7.9 Equal Utilization or the Removal of the top hamper, paddock size
 - 7.10 Grassland management principles
 - 7.11 Food trees and shrubs

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- 8. Pasture management
 - 8.1 Fertilizer
 - 8.2 Pest and weed control
 - 8.3 Biological control
 - 8.4 Irrigation
 - 8.5 Fallowing/resting
 - 8.6 Cultivation
 - 8.7 Pasture renovation
 - 8.8 Fire breaks
 - 8.9 Managing pasture after fire

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours practicals

Assessment

Continuous Assessment	40 %
2 Assignments	10%
Practical	30%
Final Examination	60 %

Prescribed Reading

1. Battaglia, R. A. (2007). *Handbook of Livestock Management*. Pearson Education Inc.
(4th Ed.). New Jersey: Upper Saddle River. ISBN 0-13-118933-6.

Recommended Reading

1. Shapiro, L. S. (2001). *Introduction to Animal Science*. Prentice-Hall Inc, Upper Saddle River, New Jersey: ISBN 0-13-920992-1.

COURSE TITLE : BEEF PRODUCTION
COURSE CODE : ANS 431
PRE-REQUISITE : ANIMAL PRODUCTION

Aim:

The aim of this course is to equip students with knowledge and skills in husbandry of beef, sheep, goat management. The course aims at providing knowledge in apiculture.

Learning Outcomes

Upon completion of the course, the students should be able to:

1. Manage beef enterprises
2. Manage dairy enterprises
3. Manage sheep and goat enterprises
4. Identify suitable breeds for different production systems
5. Perform routine management practices in sheep goats and beef
6. Identify and classify different pasture plants

7. Identify the different types of bees in a colony and their roles
8. Manage apiaries

Course Outline

1.0 Beef production

- 1.1 Importance of beef production
- 1.2 The distribution of beef cattle in Zambia and factors affecting their distribution in the traditional and commercial sectors
- 1.3 Structure of the commercial beef industry
 - 1.3.1 Pedigree studs
 - 1.3.2 Extensive ranches
 - 1.3.3 Feedlot
- 1.4 The origin and domestication of cattle
 - 1.4.1 The origin of cattle: *Bosindicus*, *BosTaurus*, and Sanga cattle
 - 1.4.2 Domestication of cattle
- 1.5 Breeds of cattle and their conformation
 - 1.5.1 Representative breeds
 - 1.5.2 Important tropical breeds
 - 1.5.3 Breeds found in Zambia
- 1.6 Breeding
 - 1.6.1 Reproduction
 - 1.6.1.1 Reproductive cycle: fertilization, gestation, calving
 - 1.6.1.2 Measures of reproductive efficiency
 - 1.6.2 Methods of breeding
 - 1.6.2.1 Crossbreeding
 - 1.6.2.2 Grading up
- 1.7 Ruminant digestion
 - 1.7.1 Protein synthesis in the rumen

- 1.7.2 Non-protein (NPN) utilization
 - 1.7.2.1 Sources
 - 1.7.2.2 Urea or carbamide
 - 1.7.2.3 Licks
 - 1.7.2.4 Urea-molasses
 - 1.7.2.5 Toxicity of urea
- 1.7.3 Nutrient requirements for fattening beef cattle
- 1.7.4 Feeding for Cyclic and compensatory growth in cattle
- 1.8 Breeding Management
 - 1.8.1.1 Factors affecting calving index: breed, nutrition, bull-cow ratio, infertility diseases, reproductive disorders, breeding age of heifers
 - 1.8.1.2 Selection of breeding stock
 - 1.8.1.2.1 Selection criteria and quantity of bulls to select
 - 1.8.1.2.2 Selection criteria and quality of heifers to select
 - 1.8.1.3 Breeding seasons
 - 1.8.1.3.1 One-year breeding
 - 1.8.1.3.1.1 Advantages of summer (rainy season) breeding
 - 1.8.1.3.1.2 Disadvantages of winter breeding
 - 1.8.1.3.2 Twice-a-year breeding
 - 1.8.1.4 Calving and dystocia management
- 1.8.2 Feeding management
 - 1.8.2.1 Nutrient requirements of different classes of beef cattle
 - 1.8.2.2 Water requirements
- 2. Dairy cattle**
 - 2.0 Production systems
 - 2.1 Breeds found in the Tropics

- 2.2 Breeding
- 2.3 Nutrient requirements of the dairy cow
- 2.4 Dairy cow management
- 2.5 Calf management
- 2.6 Heifer management
- 2.7 Management and feeding during milking
- 2.8 Milking practices
- 2.9 Housing
- 2.10 Disease management
- 2.11 Record keeping

3. Pasture Management

- 3.0 Introduction to pasture management
- 3.1 Grazing systems:
 - 3.1.1 Continuous Grazing,
 - 3.1.2 Rotational Grazing,
 - 3.1.3 Deferred Grazing,
 - 3.1.4 Strip Grazing,
 - 3.1.5 Zero Grazing,
- 3.2 Management of natural pastures (include identification of pasture speciesgrasses/legumes shrubs and trees)
 - 3.2.1 Bush control: Fire, Mechanical, Chemical and Hand
 - 3.2.2 Fire guards
 - 3.2.3 Over grazing
 - 3.2.4 Flood plain and dambo grazing
 - 3.2.5 Communal grazing
- 3.3 Conservation of forage
 - 3.3.1 Hay making

- 3.3.1.1 Management of pastures for hay making
- 3.3.1.2 Haymaking procedure
- 3.3.1.3 Nutritive value of hay
- 3.3.2 Silage making
 - 3.3.2.1 Procedure for silage making
 - 3.3.2.2 Ensilage process
 - 3.3.2.3 Nutritive value of silage
- 3.4 Fencing
 - 3.4.1 Planning a fence
 - 3.4.2 Fencing Materials
 - 3.4.3 Construction
- 3.5 Water supply
 - 3.5.1 Water requirements
 - 3.5.2 Troughs, reservoirs
 - 3.5.3 Natural water courses
- 3.6 Agroforestry

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours tutorials

Assessment

Continuous Assessment	40 %
2 Assignments	10%
2 Tests	10%

Practical	20%
Final Examination	60 %

Prescribed Textbooks:

1. Battaglia, RA 2007, *Handbook of Livestock Management*, Pearson Education Inc, 4th Edition ,Upper Saddle River, New Jersey 07458, ISBN 0-13-118933-6
2. Gillespie, RJ 1989, *Modern livestock and Poultry Production*, Delmar Publishers Inc, 4th Edition, USA, ISBN O-8273-3277-7
3. Howard, DT & Ensiminger, ME 2006, *Dairy Cattle Science*, Pearson Education Inc, 4th Edition, Upper Saddle River, New Jersey 07458, ISBN 0-13-113412-4

Recommended Textbooks

1. Shapiro, LS 2001, *Introduction to Animal Science*, Prentice-Hall Inc, Upper Saddle River, New Jersey 07458, ISBN 0-13-920992-1
2. Beekeeping Manual. FAO
3. William McElroy (2018) *Fences and Retaining Walls*

COURSE TITLE: AQUACULTURE PRODUCTION AND MANAGEMENT

COURSE CODE : ANS 441

PRE-REQUISITE : FUNDAMENTALS OF AQUACULTURE

Aim

The aim of the course is to impart knowledge and skills in designing an aquaculture system.

Also to establish and manage an aquaculture enterprise.

Learning Outcomes

At the completion of the course students should be able to:

- 1) Identify fish species suitable for specific aquaculture practices;
- 2) Demonstrate knowledge of aquaculture techniques and methodologies;
- 3) Apply knowledge of aquaculture in meeting nutrition requirements and income generation; Explain the principles of integrated aquaculture systems;
- 4) Demonstrate how limited resources at a farm can be utilized in an integrated system to efficiently produce food;
- 5) Apply knowledge of organic and inorganic fertilization in aquaculture.

Course Contents

1. Definition and Scope of Aquaculture

- i. The history of aquaculture in Zambia, the region, Africa and the rest of the world, and importance to growing populations.
- ii. The Changing environmental regimes of waters of Zambia.
- iii. The nutritional quality of aquaculture products and by products.

2. Design of Aquaculture Systems

- i. The selection of site,
- ii. Construction of ponds, reservoirs, raceways and tanks.
- iii. The management of water quality in ponds, and reservoirs

3. Culture Species Diversity

- i. The important culture species (fish, crocodile, prawn/shrimp, lobster/other crustaceans, frog, zoo and phytoplankton).

- ii. The culture of microscopic species.

4. Fish Systematic

- i. The International commission on zoological nomenclature
- ii. Rules of naming and identification.
- iii. The evolution of fishes and their classification (species description, key usage).

5. Fish Biology

- i. Anatomy and physiology of important Fish culture species,
- ii. Feeding habits, and feed spectrum of chosen culture species
- iii. Relation of feeding habits to dwelling niches and mouth shapes.
- iv. Reproduction and control of reproduction in Fish, and
- v. The breeding habits of important fish culture species.

6. Fish Ethology

- i. Fish migration, feeding and breeding
- ii. Territorial behaviour of feeding, and
- iii. Live fish transportation (conditioning).

7. Fish Nutrition

- i. The feeds types and classification in aquaculture,
- ii. Feed formulation, processing, distribution and storage
- iii. Feed quality assessment.

8. Integrated Aquaculture Systems

- i. The design and management of crop/fish/livestock structures.
- ii. The advantages and disadvantages of the integration of fish and animal production,

1. fish and bird production

b. fish and crop production.

9. Methodology of Fish Culture Systems

- i. Intensive (mono-culture),
- ii. Semi-intensive (tri-culture),
- iii. Extensive (poly and mixed cultures), and
Ranching.

10. Geographical Information Systems

- i. The local zoogeography, its suitability
(Zambia)
- ii. The importance of afforestation,
- iii. The effects of climatic on aquaculture
production.

11. Organic and Inorganic Fertilizers

- i. The fertilization of fish ponds.
- ii. The composition, application rates of fertilizers
- iii. The advantages and disadvantages of organic and inorganic
fertilizers.

12. Organic Waste Recycling

- i. The principles of organic waste
recycling.

COURSE TITLE: APPLIED ANIMAL REPRODUCTION

COURSE CODE : ANS 451

**PRE-REQUISITES: FUNDAMENTALS OF ANIMAL ANATOMY AND
 PHYSIOLOG**

Y Aim

The study of male and female organ functions, endocrinology, and common management practices related to reproduction in domestic animals will be the focus. The structure and function of each aspect will be covered in detail plus artificial insemination and palpation. **Learning Outcomes**

Upon completing this course, student should be able to:

1. Identify the organs and structures of the female and male reproductive system
2. Explain the sources and functions of the major reproductive hormones
3. State the interaction between the reproductive hormones in regulating most reproductive processes
4. Describe how the functional anatomy and hormonal regulation are integrated in reproductive process
5. Discuss synchronization of estrus, superovulation, cystic ovaries
6. Describe production, maturation, and transport of gametes and fertilization
7. Explain the importance of postpartum recovery and how it affects future reproductive efficiency
8. Discuss different ways to detect estrus
9. Evaluate, process, and handle semen

10. Describe the methods of artificial insemination
11. Know how to artificially inseminate animals
12. State the importance of good reproductive management
13. Explain the major causes of infertility and the best way to try and control them

Course Outline

1. Introduction
 - 1.1 Myth in reproduction
 - 1.2 Reproduction differentiation and development
2. Male reproductive system of an animal
 - 2.1 Male Gross anatomy plus Spermatogenesis
 - 2.2 Testicular Descent;
 - 2.2.1 Testicular Thermoregulation;
 - 2.2.2 Erection;
 - 2.2.3 Ejaculation.
 - 2.3 Male reproductive endocrinology.
 - 2.3.1 Blood Testis Barrier;
 - 2.4 Spermatogenic waves and cycles.
 - 2.5 Semen physiology
 - 2.6 Spermatozoon anatomy
3. Female reproduction system of an animal
 - 3.1 Overview of female reproductive anatomy; Folliculogenesis
 - 3.2 Ovulation;
 - 3.3 Corpus Luteum formation and function.
 - 3.4 Prostaglandins and role in reproduction; luteolysis and implantation
 - 3.5 Puberty.
 - 3.6 The Estrous Cycle;
 - 3.7 Hypothalamus and pituitary
 - 3.7.1 Neuroendocrine Control of reproduction.
 - 3.8 Steroidogenesis
 - 3.8.1 Mechanism of action of hormones.
 - 3.9 Sperm, Ova, and embryo transport;
 - 3.10 Sperm Capacitation and Acrosome
 - 3.11 Reaction; Fertilization
 - 3.12 Early embryonic development
 - 3.13 maternal recognition of pregnancy
 - 3.14 Gestation; Prenatal Development and Placentation.
 - 3.15 Reproductive management

3.16 Nutritional management

4. Assisted Animal Reproductive Technologies

4.1 Assisted animal reproductive technologies (ART).

4.2 Pregnancy diagnosis (in cow, sheep, goats, sow, mare).

4.3 Altering reproductive processes for improved reproductive efficiency.

4.4 The History of artificial insemination (AI).

4.5 The process of semen collection, composition of semen, and the methods for semen evaluation.

4.6 The processing, storage, thawing, and handling of semen and embryos.

4.7 The various insemination techniques used in cattle, pig, sheep/goats, and poultry.

4.8 The synchronisation of oestrus,

4.9 Superovulation and embryo transfer

4.10 Embryo manipulation

4.11 Bi-section

4.12 true cloning,

4.13 nuclear transfer,

5. Sexing of semen and

embryos 6. *in vitro*

maturation of gametes, 7.

in vitro fertilization

(IVF) 8. genetic

engineering.

9. Herd reproductive health analysis

10. Measures of reproductive efficiency.

11. Causes of Reproductive Failure

11.1 The causes of reproductive failure in female animals

11.2 The factors predisposing reproductive failure in male animals

11.3 The role of housing, environmental temperature and toxins, endocrine disruptors, microbial load, and toxic gases in reproductive success or failure.

12. Environmental Management for Reproductive Success

Assessment

Continuous assignments	40%
Practicals	30%
Assignment	10%
Final examination	60%

Prescribed readings

1. Senger. P.L. (2003). Pathways to pregnancy and parturition. Current Conceptions, Inc.

2. Ramon P. Jr. (2002). *Biology of Human Reproduction*. University Science Books.
3. Jones. R. E. (1997). *Human Reproductive Biology*. Academic Press.

Recommended Reading

1. Hafez, E.S.E. (Ed.). (1993). *Reproduction in farm animals*. Lea and Febiger, Philadelphia.

COURSE TITLE: AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY

COURSE CODE : AEX 412

PRE-REQUISITES : NONE

Aim

The course will equip students with knowledge in basic sociological theories to enable them work effectively with communities or farmers in solving identified problems for livelihood improvement.

Learning Outcomes

Upon successful completion of this course, students should be able to:

1. Explain the concept of Rural Sociology and its disciplinary significance;
2. Identify the factors influencing change in farming;
3. Explain the challenges rural farmers face in agriculture;
4. Identify the characteristics, typology and economic behavior of different kind farmer.
5. Identify the major social institutions and their importance in agricultural extension;
6. Define the basic concepts of extension programme management; and 7. Describe the theories, principles, processes and functions of a good manager
8. Apply managerial functions in the agricultural sector.
9. Apply knowledge and skills on managing human resource in an agricultural organization.

Course outline

A. RURAL SOCIOLOGY

1. Introduction

- 1.1. Definition of rural sociology and related concepts.
- 1.2. Rural sociology: Its significance in agriculture extension.
- 1.3. Rural areas: Challenges.
- 1.4. Settlement patterns and village organizations
 - 1.4.1 Implications on technological innovation
 - 1.4.2 Effects on extension service delivery

2. Social stratification

- 2.1 Definition
- 2.2 Theories of social stratification
- 2.4 Social mobility and barriers
- 2.5 Implications on extension service delivery

3. Major rural social institutions in Zambia

- 2.1 The family institution
- 2.2 School institutions
- 2.3 Religious institutions
- 2.4 Political institutions
- 2.5 Rural economic institutions

4. Socialization

- 4.4 Meaning of socialization
 - 4.5 Agents of socialization
5. **Social Change:** Meaning, Nature of Social change and factors of social change.
6. **Social Control:** Meaning, need and means of social control.
7. **Rural Leadership:** Types and roles of leaders in rural context.

B. AGRICULTURAL EXTENSION

1. Introduction

- 1.1 Definition of extension
- 1.2 Scope of agricultural extension
- 1.3 Principles of agricultural extension

2. Theoretical antecedents of extension approaches

- 2.1 Definition of extension approach
- 2.2 Conventional extension approaches
- 2.3 Participatory extension approaches

3. New Trends in agricultural extension

- 3.1 Privatization
- 3.2 Liberalization
- 3.3 Pluralistic extension
- 3.4 e-extension
- 3.5 Farmer-led extension

4. Planning, Monitoring and Evaluating extension programs

- 4.1.1 Stages in extension program planning
- 4.1.2 Monitoring and Evaluating Extension programs

5. Extension methodologies

- 5.1 Extension methods: Individual, Group and Mas
- 5.2 Extension techniques: Farm and Home visits, Field Days, Demonstration, Agricultural shows etc.

6. Group dynamics

- 6.1 Meaning of group and group dynamics.
- 6.2 Types and sizes of groups
- 6.3 Conflicts in groups
- 6.4 Importance of group dynamics in co-operatives/farmer group
- 6.5 Factors considered in formation of groups

7. Agricultural extension management

- 7.1 Theories of management
- 7.2 Functions of management
- 7.3 Theories of motivation
- 7.4 Motivating employees
- 7.5 Managing extension organization
- 7.6 Challenges of managing extension organizations

Suggested practicals

- 1.0 A visit to a village to understand the problems being encountered by the villagers/farmers; and conduct needs analysis;

2.0 Visit any extension organization (NGO, CSO, CBO, PO, Ministry) and find out its functions and experience in service delivery;

3.0 Exposure visit to mass media and find out how agricultural extension messages are disseminated.

Duration: 15 weeks

Contact Hours

3 hours lectures per week

2 hours tutorials

Assessment

Continuous Assessment	40 %
2 Assignments	
10% 2 Tests	
30%	
Final Examination	60 %

Prescribed Readings

1. Chitamber, J. B. (1997). *Introductory Rural Sociology*. New Delhi: Wiley Eastern Limited.
2. Jibowo, G. (1992). *Essentials of Rural Sociology*. Abeokuta: Gbemisodipo Press Ltd.1–6.
3. N. E. Mundi, N. E. (2008). AEM 202 Module: Introduction to rural sociology. National Open University of Nigeria. ISBN: 978-058-773-6
4. Ray, G. L. (2017). *Extension Communication and Management*. New Delhi: Kalyani Publisher. pp 227-248.
5. Van den Ban, A.W. and Hawkins, H.S. (2002). *Agricultural Extension*. New Delhi: CBS Publishers and Distributors.
6. Mondal, S. (2019). *Fundamentals of Agricultural Extension Education*. New Delhi: Kalyani publishers,

7. Jones, G.E. and Garforth, C. (1997). "The History, Development, and Future of Agricultural Extension." In: Swanson, B.E., Bentz, R.P. and Sofranko, A.J. (Eds.). *Improving Agricultural Extension: A Reference Manual*, FAO, Rome, Italy.
8. Abott, J. (1995). Community participation and its relationship to community development. *Community Development Journal*. 30 (2). Oxford: Oxford University Press. pp 158-169.

Recommended Readings

1. Vidyabhushan and Sach Dev, D. R. (1998). *An Introduction to Sociology*. Kitab Mahal. Agencies, Allahabad.
2. Rao, C. N. S. (2015). *Sociology*. New Delhi: S. Chand & Company.
3. Doshi, S. L. (2007). *Rural sociology*. New Delhi: Rawat Publishers.
4. De, D. and Jirli, B. (2010). *A Handbook of Extension Education*. Jodhpur, Agrobios (India).
5. Sharma, O. P. & Somani, L. L. (2012). Dimension of Agricultural Extension, Agrotech Publishing Academy. Udaipur.
6. Burkey, S. (1993). People first: A guide to self-reliant, participatory rural development. London, Zed Books Ltd.

COURSE TITLE : **RANGE MANAGEMENT**
COURSE CODE : **ANS 422**
PREREQUISITES : **PASTURE PRODUCTION AND FORAGE MANAGEMENT**

Aim

The main aim of the course is for students to explore the foundations of rangeland ecology and management while also bringing into perspective the many factors that rangeland managers must navigate while trying to find adaptive management solutions to complex problems. **Learning Outcomes**

Upon completion of this course, students should be able to:

1. Describe how rangeland and rangeland management and the rangeland science what proteins and other related concepts are
2. Describe the many characteristics that comprise rangelands
3. Identify the dominant rangeland types of Zambia
4. State the grazing and browsing animal behaviour
5. Explain methods for using animal behaviour to better manage rangeland vegetation and resources

Course outline

1. Definition of rangeland

2. Types of rangelands
 - 2.1 Grasslands
 - 2.2 Shrub land
 - 2.3 Woodland
 - 2.4 Savanna
3. Characteristics of rangelands
 - 3.1 Low rainfall/moisture stress
 - 3.2 Not suitable for agriculture
 - 3.3 Degraded land/rocky/stony
 - 3.4 Shallow soil
 - 3.5 Poor drainage
4. Range ecosystems
 - 4.1 Tropical rangelands
 - 4.2 Sub-tropical rangelands
5. Forage resources
 - 5.1 Cropland
 - 5.2 Rangeland
 - 5.3 Wasteland
6. Rangeland ecology and animal behaviour
 - 6.1 Definition of defoliation
 - 6.2 Effects of defoliation on:
 - 6.2.1 Plant morphology
 - 6.2.2 Plant physiology
 - 6.2.3 Vegetative reproduction
 - 6.2.4 Seed production
 - 6.2.5 Root system
 - 6.2.6 Soil condition
 - 6.2.7 Plant conditions
 - 6.3 Factors affecting phenomenon of defoliation
 - 6.2.1 Species to species
 - 6.2.2 Season/timing
 - 6.2.3 Frequency
 - 6.2.4 Intensity
 - 6.2.5 Cutting height Stage of maturity
 - 6.2.6 Carbohydrate cycle in the grass
 - 6.2.7 Grazing resistance capacity
7. Grasslands

- 7.1 Types of grasslands
 - 7.1.1 Natural grasslands
 - 7.1.2 Artificial Grasslands
- 7.2 Factors affecting grasslands
 - 7.2.1 Climatic factors
 - 7.2.2 Edaphic factors
 - 7.2.3 Biotic factors
- 7.3 Factors defining Grassland
 - 7.3.1 Stress
 - 7.3.2 Fire
 - 7.3.3 Grazing
 - 7.3.4 Land clearing
- 8. Plant succession
 - 8.1 Definition of plant succession
 - 8.2 Types of succession
 - 8.2.1 Primary succession
 - 8.2.2 Secondary succession
 - 8.2.3 Progressive succession
 - 8.2.4 Retrogressive succession
- 9. Grazing behaviour of livestock
 - 9.1 Goats
 - 9.2 Cattle
- 10. Palatability and preference
 - 10.1 Definition of palatability and preference
 - 10.2 Preference index
 - 10.3 Factors influencing forage palatability
 - 10.3.1 Plant factors
 - 10.3.2 Animal factors
 - 10.3.3 Environmental factors
- 11. Methods of vegetation analysis
 - 11.1 Local people discussion and their experience
 - 11.2 Survey of the range area
 - 11.3 General observation
 - 11.4 Point/frame/hit method
 - 11.5 Visual estimation
 - 11.6 Line interception method
- 12. Carrying and grazing capacity

- 12.1 Carrying capacity
- 12.2 Grazing capacity
- 13. Methods of Range improvement
 - 13.1 Direct
 - 13.2 Indirect
- 14. Grazing management
 - 14.1 Indigenous hording system
 - 14.2 Transhumance system
 - 14.3 Sedentary system
 - 14.4 Stall feeding system

Assessment

Continuous test	40%
Final examination	60%

Prescribed Reading

1. Briske, D.D., Fuhlendorf, S.D and Smeins, F.E. (2003). Vegetation Dynamics on Rangelanda: A Critique Of The Current Paradigms. Journal Of Applied Ecology 40:601-614

Recommended reading

2. Brown J.K and Kapler J.S. Eds. (2000). Wildland Fire in Ecosystems: Effects of the fire on Flora.

COURSE TITLE: DAIRY PRODUCTION

COURSE CODE : ANS 432

PRE-REQUISITE : ANIMAL PRODUCTION

Aim:

To impart knowledge and skills in students on dairy cattle and dairy goat production

Learning Outcomes

Upon successful completion of the course students should be able to:

1. Identify different breeds of dairy cattle and goats
2. Conduct routine management practices of dairy cattle and goats
3. Keep proper dairy records

Course outline

1.0 Dairy Cattle

- 1.1** Introduction
- 1.2** Production trends
- 1.3** Dairy production in different sectors
 - 1.3.1 Traditional
 - 1.3.2 Intermediate
 - 1.3.3 Commercial
- 1.4 Anatomy of the udder
 - 1.4.1 Secretory tissue
 - 1.4.2 Supportive tissue
 - 1.4.3 Blood and nerves
- 2.0 Breeding**
- 2.1** Reproduction
 - 2.1.1 Reproductive cycle: fertilization, gestation, calving
 - 2.1.2 Measures of reproductive efficiency
- 2.2 Methods of breeding
 - 2.2.1 Crossbreeding
 - 2.2.2 Grading up
- 3.0 Management**
- 3.1 Rearing and selection of dairy breeding animals
 - 3.1.1 Replacement heifers
 - 3.1.2 Dairy bulls
- 3.2 Breeding dairy cattle
 - 3.2.1 Estrus cycle-pro-estrus, estrus, metestrus, diestrus
 - 3.2.2 Signs of estrus

- 3.2.3 Artificial insemination
- 3.2.4 Natural service
- 3.3 Calving and dystocia
- 3.4 Calf rearing
 - 3.4.1 Importance of colostrum
 - 3.4.2 Bucket rearing
 - 3.4.3 Introducing solids
 - 3.4.4 Housing calves
- 4.0 **Milk production**
- 4.1 Annual cycle of the dairy cow
- 4.2 Anatomy of the udder
 - 4.2.1 Secretory tissue
 - 4.2.2 Supportive tissue
 - 4.2.3 Blood and nerves
- 4.3 Milk-let down reflex
- 4.4 The lactation curve
 - 4.4.1 Factors affecting milk yield
 - 4.4.2 Factors affecting milk composition
- 4.5 Methods of milking
 - 4.5.1 Hand milking
- 4.6 Processing
 - 4.6.1 Pasteurization
 - 4.6.2 Milk products- Cream, butter, cheese
 - 4.6.3 Butter-oil making/cheese

4.6.4 Cooling

4.6.5 Storage

5.0 **Health and disease**

5.1 Diseases of the udder

5.1.1 Mastitis- causal organisms, predisposing factors, clinical signs, treatment, prevention

5.1.2 Infertility diseases and their causal organisms, clinical signs and control

5.1.2.1 Brucellosis

5.1.2.2 Trichomoniasis

5.1.2.3 Anthrax

5.1.2.4 Tuberculosis

5.1.2.5 Blackleg

6.0 **Feeding management**

6.1 Simple ration formulation

6.2 Maintenance/production rations

6.3 Mineral supplementation

6.4 Dry cow feeding using forages and concentrates

7.0 **Record keeping**

7.1 Dairy record sheet for milk yield

7.2 Other records Hand milking and parlor sanitation

8.0 **Dairy Goats**

8.1 Introduction

8.1.1 Production trends

8.1.2 Dairy production in different sectors

8.1.2.1 Traditional

8.1.2.2 Intermediate

8.1.2.3 Commercial

9.0 **Anatomy of the udder**

9.1 Secretory tissue

9.2 Supportive tissue

9.3 Blood and nerves

10.0 **Breeding**

10.1 Reproduction

10.1.1 Reproductive cycle: fertilization, gestation, calving

10.1.2 Measures of reproductive efficiency

10.2 Methods of breeding

10.2.1 Crossbreeding

10.2.2 Grading up

10.3 Management

10.4 Rearing and selection of dairy breeding animals

10.4.1 Replacement heifers

10.4.2 Dairy bulls

10.5 Breeding dairy cattle

10.5.1 Estrus cycle-pro-estrus, estrus, metestrus, diestrus

10.5.2 Signs of estrus

10.5.3 Artificial insemination

10.5.4 Natural service

10.6 Calving and dystocia

10.7 Calf rearing

10.7.1 Importance of colostrum

10.7.2 Bucket rearing

10.7.3 Introducing solids

10.7.4 Housing calves

10.8 Milk production

10.8.1 Annual cycle of the dairy cow

10.8.2 Anatomy of the udder

10.8.2.1 Secretory tissue

10.8.2.2 Supportive tissue

10.8.2.3 Blood and nerves

10.8.3 Milk-let down reflex

10.8.4 The lactation curve

10.8.5 Factors affecting milk yield

10.8.6 Factors affecting milk composition

10.8.7 Methods of milking

10.8.8 Hand milking

10.9 Processing

10.9.1 Bio security (Shower, overalls etc.)

10.9.2 Pasteurization

10.9.3 Milk products- Cream, butter, cheese

10.9.4 Butter-oil making/cheese

10.9.5 Cooling

10.9.6 Storage

11.0 **Health and disease**

11.1 Diseases of the udder

11.1.1 Mastitis- causal organisms, predisposing factors, clinical signs, treatment, prevention

11.2 Infertility diseases and their causal organisms, clinical signs and control

11.2.1 Brucellosis

11.2.2 Trichomoniasis

11.2.3 Anthrax

11.2.4 Tuberculosis

11.2.5 Blackleg

12.0 **Feeding management**

12.1 Simple ration formulation

12.2 Maintenance/production rations

12.3 Mineral supplementation

12.4 Dry cow feeding using forages and concentrates

13.0 **Record keeping**

13.1 Dairy record sheet for milk yield

13.2 Other records Hand milking and parlor sanitation

14.0 Marketing of milk

Practicals

Dairy production

1. Introduction to the dairy unit of the college farm
2. Hand milking and parlor sanitation
3. Calf rearing
4. Visit to a Milk Processing Company

5. Cream separation and butter making
6. Machine milking
7. Visit to a commercial dairy farm

Assessment	40%
Tests	10%
Practicals	30%
Final examination	60%

Prescribed Textbook

1. Howard, DT & Ensiminger, ME 2006, *Dairy Cattle Science*, Pearson Education Inc, 4th Edition, Upper Saddle River, New Jersey 07458, ISBN 0-13-113412-4

Recommended Textbooks

1. Gillespie, RJ 1989, *Modern livestock and Poultry Production*, Delmar Publishers Inc, 4th Edition, USA, ISBN 0-8273-3277-7
2. Shapiro, LS 2001, *Introduction to Animal Science*, Prentice-Hall Inc, Upper Saddle River, New Jersey 07458, ISBN 0-13-920992-1

COURSE TITLE: ANIMAL PRODUCTS AND BY-PRODUCTS

COURSE CODE : ANS 442

PRE-REQUISITE : ANIMAL PRODUCTION

Aim

This course is aimed at imparting knowledge on the various animal products and byproducts, including processing skills and value addition.

Learning Outcomes

Upon completion of the course, students should be able to:

- Define meat and milk according to local and international standards.
- Conduct humane slaughter of food animals.
- Explain quality of the products and by-products from farm animals.
- Apply skills in food processing to animal products.
- Explain processing of hides and skins and the value of these products to the economy.

Course Contents

A. Animal Products and By-Products

1. Introduction

Define animal products and by-products, meat by-products, and livestock processing technologies.

2. Meat

Define Meat and explain slaughter of animals and conversion of muscle to meat, the factors affecting muscle characteristics of meat quality. Explain animal production factors, stress and stress-susceptibility factors, post-mortem temperature, post-mortem handling practices, properties of fresh meat, eating quality of meat, meat processing and preservation, and grading carcasses of meat animals.

3. Milk

Define milk and review lactation. Explain milk composition, milk hygiene, milk adulteration, milk contamination, milk-borne infections and intoxicants, milk processing, production of quality milk, milk defects in flavour (off-flavours), and colour. Describe dairy products.

4. Eggs

Explain egg structure and processing. Describe the physical characteristics of an egg and grading (size, shape, colour, abnormalities). Describe the versatile egg: uses, functional properties of an egg, its nutritional value and nutritional misconceptions.

5. Hides and Skins

Define hides and skins and explain the origin of processing and use of hides and skins. Review the structure skin and explain the terminologies, defects and faults in hides and skins. Explain the prevention of defects/faults in hides (during life of an animal, slaughter, processing, storage, and transportation), the curing, grading, storage, and packaging of hides and skins. Define and describe tanning.

6. Bones, Meat & Bone Meal, and Blood Meal

Explain the use of bones as by-products (production of stock feeds, steamed bone meal, gelatin and glue production), meat meal or meat & bone meal.

Explain blood: use of fresh blood as a stock feed.

Assessment

• Continuous Assessment	40%
Practicals	20%
Tests	20%
• Final Exam	60%

Prescribed Readings

1. Lawrie, R.A. and Ledward, D.A. (2006). Lawrie's Meat Science, 7th Ed. Woodhead Publishing Co., Cambridge, UK.
2. Hui, Y.H. (2012). Handbook of Meat and Meat Processing, 2nd Ed. CRC Press, Boca Raton, FL., US.
3. Feiner, G. (2006). Meat Products Handbook. Woodhead Publishing Co., Cambridge, UK

Recommended Readings

1. Kinsman, D.M., Kotula, A.W. and Breidenstein, B.C. (1994). Muscle Foods (meat, poultry and sea food technology). Chapman and Hall, London, UK.
2. Journals: Meat Science, International Journal of Food Microbiology, Journal of Food Science.

COURSE TITLE:

RESEARCH PROJECT

COURSE CODE : ANS 452

PRE REQUISITES : **EXPERIMENTAL DESIGN AND ANALYSIS
FOR AGRICULTURE RESEARCH**

Aim

The aim is to expose students to the practical aspects of agriculture so that they practice theoretical concepts and appreciate the value of agriculture in their lives. This course also aims at stimulating initiative and creative thinking in the learners. It has to be conducted for the whole year.

Learning Outcomes

By the end of this course, students should be able to:

1. Demonstrate in-depth understanding of agricultural research project and practices in his or her field of study;
2. Demonstrate practical skills for implementing laboratory and field procedures, as appropriate to the degree program, involving collection, interpretation and presentation of experimental information;
3. Apply research to solve emerging issues in agricultural research project.
4. Produce a report with appropriate procedures;
5. Demonstrate appropriate referencing skills;
5. Do oral presentation of the findings.

Course outline

- i. Report writing
- ii. Research report defence and submission

Projects in Agriculture

The projects will be marked (assessed) as soon as they are submitted and marks stored safely.

Planning and choice of projects

Project work requires planning and execution in a logical sequence. Students are guided through questions and suggestions by their lecturers in order to arrive at a result that can be analyzed and conclusion drawn. Although it is better for students to do the project individually, certain projects may be carried out in pairs or in

groups of 3 to 5 to gather data, except, that the analysis of data must be done individually.

Each student is required to maintain records of the project work in an exercise book or file provided for this purpose. These records should be available for inspection and assessment regularly until the end of the project by the dean of the school and the Chief Internal Examiner. The students are allowed to

- (a) To choose their own project for investigation
- (b) Select the topic for investigation from the list of suggested projects availed by the lecturer.

Projects may consist of

- (a) An investigation of growth, management and marketing of a particular animal(s), bird(s) or crop(s);
- (b) An investigation of a particular aspect of the local agricultural practice.

Some topics for project work

Livestock

- (i) Compare the effectiveness of feeds from different manufacturers
- (ii) Effects of livestock population in a given locality
- (iii) Investigate the effects of taboos on livestock rearing
- (iv) Comparing growth rates in livestock
- (v) Food conversion ratio in animals
- (vi) Choice of enterprise in animals

Others

- (i) Investigate the effectiveness of marketing policies
- (ii) Investigate the effect of certain farming systems on the locality
- (iii) Tracing the history of agriculture in a given area
- (iv) Identify research topics/challenges from the environment, develop them and sale eg domesticating grass from the bush, raising earthworms to generate manure ie research and development
- (v) Culture, attitude Vs farming
- (vi) To analyse and verify researches done by others

It is suggested that

- (i) The two projects must be spaced such that one project is completed before the other begins. It is a good idea to start the first project in the first term of the fourth year.
- (ii) Project work should be carried out during the students' own time, but regular checks on progress by the tutor should be made and in case of negligence; every effort should be made to motivate the student. Lecturers must expect a high standard of work from

their students at all times and the quality of pupils' work should be monitored upon from time to time.

- (iii) In organizing the projects, the initiative and creativity of the students must be promoted.
- (iv) The organization and supervision of project work should be the collective responsibility of all agricultural science lecturers in the university.

Data collection

Data for analysis must come from the learners' personal observations and measurements; it should be collected from the field by the learners themselves.

The data collected should form the basis for analysis.

It is imperative that the learner collects sufficient data from the project to enable the learner carryout adequate analysis and interpretation.

Project assessment

Each student will be awarded marks for i) Project Proposal [20], ii) Project execution [20], iii) Project presentation [20] and iv) Project Report (Dissertation) [40]. For purposes of grade processing, the marks for Project Proposal and Project Execution shall constitute the continuous assessment while the rest constitute the final examination marks.

**THE STUDENT PROJECT EVALUATION SHEET
PROJECT PRESENTATION AND DISSERTATION REPORT**

Name of student: **Student No:**

Year of study:

Aspect of assessment	Maximum marks	Marks
Topic and title	2	
Aim(s)	3	
Hypothesis	5	
Method /procedure	25	
Observation and recording	20	
Analysis	25	

Problems and limitations	5	
Conclusion	10	
Recommendations	5	
Interest and commitment	5	
Total score	100	X
Actual score out of 10= X/10	10	

Supervisor's Comments

.....

Supervisor's Name and Signature

Date.....

The supervisor must comment on the students' performance, resulting from their ability or inability to carry out or conclude a project or failure to hand in the project report.

APPENDIX 2

Teaching Staff Curriculum Vitae

NAME: COLLEN MWEEMBA

SCHOOL: School of Agriculture

CURRENT POSITION: Full Time Lecturer-Programme Coordinator

COURSES TAUGHT

- Animal Genetics
- Sheep, Goat & Rabbit Production
- Poultry Production
- Beef Production
- Range Management
- Animal Products and By-Products

ACADEMIC QUALIFICATIONS

- National Livestock Breeding Centre, (NLBC), Shirakawa, Japan, Department of agriculture.
Cert.in Livestock development policy training,2012.
- University of Aberdeen, Scotland, United Kingdom. Department of Agriculture MSc in Animal production,1997.
- National Institute of Public Administration INTAN Kuala Lumpur, Malaysia
Department of agriculture
Cert.in managing agriculture systems,1994.
- University of Zambia, Lusaka, Zambia
Department of agriculture
Adv.cert in Agriculture Project Planning and Appraisal,1993
- Lowenstein International Agriculture College, Deventer, The Netherland,
Department of Agriculture.
Post grad. Diploma in Tropical animal production,1990.
- University of Agriculture (Sokoine), Morogoro, Tanzania Department of agriculture BSc.in Agriculture,1986.
- Zambian college of agriculture, Monze in conjunction with Wolverhampton Polytechnic
Department of education
Cert.in teaching methods,1983.
- Zambia College of Agriculture, Monze in conjunction with Wolverhampton Polytechnic.
Department of agriculture
Cert.in natural resources teaching methods,1982.
- Natural Resources Development College, Lusaka, Zambia
Department of agriculture
Dip.in livestock science and production,1981

- Chipepo Secondary School, Chisekesi, Zambia
Secondary school
School certificate, 1977.

PROFESSIONAL MEMBERSHIP

- Associate member technical Evaluation of Service providers and Consultants for Small Holder Agri. Business Promotion Programme (SAPP) & Smallholder Livestock Investment Project (SLIP).
- Associate member, Developing Livestock Field Extension Training Modules on Pigs, Village chickens and Goat production according to market specifications for Small Holder Agric - business Promotion Programme (SAPP).

ACADEMIC EMPLOYMENT HISTORY (*including Honorary and Adjunct Positions*)

- 2012-present part time lecturer, School of Veterinary Medicine, University of Zambia, Lusaka, Zambia.
- 2012-present part time lecturer, School of agriculture, Open university, Lusaka, Zambia.
- 1986-1991 lecturer/trainer of officers, ministry of agriculture, Mpika, Zambia.

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY HISTORY

- 2017 June-2017 September Livestock expert, Southern Africa Regional Livestock and Leather, Lusaka, Zambia.
- 2014-2017 March, Livestock specialist, smallholder Agri business promotion programme, Lusaka, Zambia.
- 2009-2014 chief livestock production officer, Ministry of livestock and fisheries, Lusaka, Zambia.
- 1991-1992 Head of animal production department, ministry of agriculture and livestock, Mpika, Zambia.
- 1981-1986 practical instructor, ministry of agriculture and cooperatives, Monze, Zambia.

- Research consultancy report on “Water Pollution and Poor Sanitation in Mpika Township” for the Mpika Environmental Support Programme (ESP), jointly written and carried out with Mr. P.K. Lungu, TAZCOR Services special project, 2002.
- Consultancy paper for a Non-Governmental Organization (NGO) for Economic Expansion in outlying Areas (EEOA), meant for a short course in poultry production as a business 2 000.
- Consultancy paper written for the World Vision (Z) an NGO on ‘Cattle rearing guide for small-scale farmers of Senior Chief Kopa, Mpika District 2000.

RESEARCH INTERESTS

- Animal Genetics
- Animal Products

PUBLICATIONS (*last 5 years*)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	0	2

NAME: IKABONGO MUKUMBUTA

SCHOOL: School of Agriculture

CURRENT POSITION: Full Time Lecturer

COURSES TAUGHT

- Farm Structures
- Climate Change and Variability
- Principles of Agro Climatology

ACADEMIC QUALIFICATIONS

- University Hokkaido, Japan, Department of agriculture.
PhD, Soil Science and Environmental Resources.
Research theme: Monitoring and mitigation of greenhouse gas emissions and soil carbon loss in agricultural ecosystems,2017.
- University Hokkaido, Japan,
Department of agriculture
Post graduate Diploma, International Environmental Leadership,2015.
- University Hokkaido, Japan,
Department of agriculture
Post graduate diploma in Post Graduate Diploma, Sustainability Science,2015.
- University Hokkaido, Japan, Department of agriculture MSc in agriculture,2014.
- University of Zambia, Lusaka, Zambia, School of agriculture
BSc in Agriculture,2010.

PROFESSIONAL MEMBERSHIP

- Associate member of JICA's "Kabwe Mine Pollution Amelioration Initiative" project. One of local experts in monitoring and ameliorating the effect lead mining pollution in soils and food crops.

ACADEMIC EMPLOYMENT HISTORY (including Honorary and Adjunct Positions)

- 2010-2011 Teaching assistant, School of agriculture, University of Zambia, Lusaka, Zambia.
- 2014-2017 Teaching assistant, Department of agriculture, Hokkaido university, Japan.

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY

HISTORY

- 2010-2011 High school teacher, ministry of education, Lusaka, Zambia
- 2011, 2011 Sep Project consultant, Njuwe consultants, Lusaka, Zambia.

RESEARCH INTERESTS

Soil Science
Environmental Resources

PUBLICATIONS (*last 5 years*)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
1	0	3	2

NAME: CHANAMWE SONDO

SCHOOL: School of Agriculture

CURRENT POSITION: Full Time Lecturer

COURSES TAUGHT

- Agricultural Extension and Rural Sociology
- Farm Management
- Crop Production

ACADEMIC QUALIFICATIONS

- University of Malawi, Lilongwe, Malawi,
Department of Rural Development and Extension
MSc in Rural Development and Agriculture Extension, September, 2011.
- University of Zambia, School of education, Lusaka, Zambia
Department of Adult Education
BSc of Adult Education (BAE), June, 2004
- University of Zambia Department of Adult Education Diploma in Adult Education, 2000.
- University of Zambia, School of education, Lusaka, Zambia
Department of Adult Education
Certificate in Adult Education (CAE), 1999.
- Zambia Centre for Horticultural Training (ZCHT) Lusaka, Zambia,
Department of agriculture
Advanced certificate in Horticulture, 1993
- Zambia College of Agriculture (ZCA), Mpika, Zambia
Department of agriculture
Certificate in General Agriculture, July, 1988.

PROFESSIONAL MEMBERSHIP

- Program expert evaluator for Agricultural Extension and Education programs at Higher Education Authority (HEA).
- Member, Adult Education Association of Zambia
- Teaching Council of Zambia (Prospective)
- Technical Vocational Entrepreneurship Training (TEVET)

ACADEMIC EMPLOYMENT HISTORY (including Honorary and Adjunct Positions)

-
- 2016-present: Senior Lecturer, Department of Agricultural Education and Extension, Natural Resources Development College, Ministry of Agriculture, Zambia.
 - 2005-2012: Lecturer, Department of Agricultural Education and Extension Natural Resources Development College, Ministry of Agriculture, Zambia.

- 2006-2008: Part-Time lecturer, Department of Adult Education and Extension Studies.
University of Zambia, Zambia.

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY HISTORY

- 1988-2005: Agriculture Assistant, Ministry of Agriculture and Cooperatives, Zambia.
- 2013 -2014: A consultant in Biodiversity International, a partner of the Aquatic Agricultural Systems (AAS) hub in Zambia.

RESEARCH INTERESTS

- Rural Development

PUBLICATIONS (*last 5 years*)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	1	0

NAME: NICHOLUS OBBY MAINZA

SCHOOL: School of Agriculture

CURRENT POSITION: Full Time Lecturer

RSES TAUGHT

- Farm Accounts & Introductory Agricultural Economics
- Entrepreneurship and Innovation
- Farm Management

ACADEMIC QUALIFICATIONS

- University of Lusaka, Lusaka, Zambia
School of Agriculture
PhD Agric and Agribusiness,2021(candidate)

PhD research is analyzing effects of membership to co-operative on income generation among smallholder farmers in Central province of Zambia.

- Nkhruma university, Kabwe ,Zambia
Department of Agriculture
Post graduate diploma teaching methodology,2019.
- Mulungushi University, Kabwe, Zambia,
School of Agriculture
MSc degree Agribusiness,2018.
- Solusi University, Bulawayo, Zimbabwe, School of agriculture BSc
agribusiness,2016.
- Crescent kids Institute, Lusaka, Zambia
Computer studies section
Cert.in computer skills,2007.
- Zambia College of Agriculture, Lusaka, Zambia
Agriculture studies section
Certificate in General Agriculture,2007.
- Canisius High school, Zambia School Certificate,2004.

PROFESSIONAL MEMBERSHIP

- Executive Member Economics Association of Zambia (EAZ)

ACADEMIC EMPLOYMENT HISTORY *(including Honorary and Adjunct Positions)*

- 2019-2020 Part time, entrepreneurship section, Immaculate Teachers' Training College, Zambia.

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY

HISTORY

- 2020 – Date ---District agricultural coordinator, Ministry of Agriculture, Mumbwa, Zambia.
- 2018 – 2019 --- Actg. Senior Marketing Development Office, Ministry of Agriculture Central province, Zambia.

- 2016 –District Marketing Development Officer, Ministry of Agriculture, Chibombo, Zambia.
- 2008 – 2016 --- Extension Services Officer, Ministry of Agriculture, Chibombo ,Zambia.
- 2009 – 2015 --- Part time CFU-Field Officer Conservation Farming Unit, Zambia.
- 2014 – 2015 --- Part time DAPP-Field Facilitator Farmers’ Club, Zambia.
- 2015 - 2016 --- APPSA-Field Coordinator, Agriculture Productivity Program for Southern Africa ,Lusaka, Zambia.

RESEARCH INTERESTS

- Agribusiness

PUBLICATIONS (*last 5 years*)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	0	0

NAME: BRIAN MALAMBO

SCHOOL: School of Agriculture

CURRENT POSITION: Full Time Lecturer

COURSES TAUGHT

- Field Crop Production
- Pasture Management & Forage Production

ACADEMIC QUALIFICATIONS

- University of Reading, England Department of agriculture
MSc agriculture development,2000.
- University of Zambia,
School of agriculture
BSc in agriculture science,1995.

- Kambule technical secondary school, School certificate, 1989.

PROFESSIONAL MEMBERSHIP

- Chairman of the regulatory committee of crop life, Zambia
- Vice chairman of crop life Zambia
- Contributor of technical articles to Agri business news a monthly agricultural magazine.

ACADEMIC EMPLOYMENT HISTORY (*including Honorary and Adjunct Positions*)

- 2019-present, Lecturer, School of agriculture, University of Zambia, Lusaka, Zambia.

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY HISTORY

- 2017-2019 head technical department, Syngenta Zambia, Lusaka, Zambia.
- 2011-2017 Technical manager for southern Africa BASF, Lusaka, Zambia.
- 2007-2011 General manager, Ripple S ranch Ltd.
- 1996-2004 Technical Agronomist, Mpongwe development company, Zambia.

RESEARCH INTERESTS

- Crop Production

PUBLICATIONS (*last 5 years*)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	0	1

NAME: LASTON C.C MILAMBO

SCHOOL: School of Agriculture

CURRENT POSITION: Full Time Lecturer

COURSES TAUGHT

- Introduction to Agriculture
- Introduction to Agricultural Botany

ACADEMIC QUALIFICATIONS

- University of East Angria,UK
School of agriculture
MSc degree in crop science,1995.
- University of Zambia, Lusaka, Zambia
School of agriculture
BSc degree in agriculture,1990.
- Natural resources development College, Lusaka, Zambia
Department of agriculture
Diploma in agriculture,1984.

PROFESSIONAL MEMBERSHIP

Nil

ACADEMIC EMPLOYMENT HISTORY (*including Honorary and Adjunct*

Positions

- 2009-Present,Part time lecturer, School of agriculture ,Mulungushi University, Kabwe, Zambia.

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY HISTORY

- 1984-2020.Agriculture officer ,Ministry of Agriculture, Lusaka ,Zambia
- 2013-2017 Project coordinator, Agriculture productivity program, Lusaka, Zambia.
- 2010-2013 Principle agricultural research officer, ZARI ,Kabwe, Zambia.
- 1990-2004 Agriculture research officer ,Soil and crops research division of ZARI.
- 1984-1990 Agricultural research supervisor, ZARI, Kabwe ,Zambia.

RESEARCH INTERESTS

- Agriculture

PUBLICATIONS (*last 5 years*)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	1	0

NAME: LLOYD NSINGO

SCHOOL: School of Agriculture

CURRENT POSITION: Full Time Lecturer

COURSES TAUGHT

- Introductory Biology
- Zoology
- Botany

ACADEMIC QUALIFICATIONS

- University of Namibia, Rundu, Namibia
Department of education
Master of education,2014.
- University of Namibia, Rundu, Namibia
Department of education
Bachelor of education,2012.
- Spessis college, Bulawayo, Zimbabwe Department of information and technology
Diploma in micro computer technology,1997.
- City and Guilds, UK
Department of ICT
Certificate in micro computer technology,1997.
- Institute of data processing management, London, UK
Department of technology
Diploma in data processing,1993.
- National institute of public administration,
Department of Technology
Certificate in computer programming, Lusaka, Zambia.
- Luangwa secondary school GCSE certificate, Zambia,1986.

PROFESSIONAL MEMBERSHIP

- Member of teaching council of Zambia.
- Chapter Member of Southern African Association of Researchers in Mathematics, Science and Technology Education (SAARMSTE), Namibia.
- Full Member of Southern African Association of Researchers in Mathematics, Science and Technology Education (SAARMSTE).
- Member of National Commission on Research, Science and Technology (NCRST), Namibia.
- Member of Continuing Professional Development of Educational Editors (CPDJE), Namibia.
- Member of the National Professional Standards for Teachers, Namibia.

ACADEMIC EMPLOYMENT HISTORY (including Honorary and Adjunct Positions)

- 2017-Present research lecturer and supervisor, Department of Under/post graduate, University of Lusaka, Lusaka, Zambia.
- 2010-2015 guest lecture, University of Namibia, Namibia
- Current guest lecturer(research), National institute of public administration, Lusaka, Zambia.
- Guest lecturer (Biology), Africa research University, Lusaka, Zambia.

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY
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HISTORY

- 2002-2006, Manager, Hilperton Investments, Zimbabwe.
- 1999-2001, Assistant to the Managing Director, Jilomi Holdings, Lusaka, Zambia.
- 1987-1996, Proof Reader and Composer, Government Printers, Lusaka, Zambia.

RESEARCH INTERESTS

- Field of Biology

PUBLICATIONS (last 5 years)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
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0	0	0	3

NAME: ENOCK DONALD PHIRI

SCHOOL: School of Agriculture

CURRENT POSITION: Full Time Lecturer

COURSES TAUGHT

- Zoology
- Pig Production
- Dairy Production

ACADEMIC QUALIFICATIONS

- University of Edinburgh, Scotland United Kingdom.
School of Agriculture
Master of Science (MSc) Degree in Tropical Animal Production and Health,1993.
- Natural Resources Development College,Lusaka, Zambia
Department of agriculture
Diploma in Livestock Science and Production,1977.
- Odenkirk Practical Training Centre, Netherlands
Department of Agriculture
Post Graduate Diploma (PGD) in Dairy Husbandry and Milk Processing,1988.
- University of Jerusalem,Jerusalem
School of Agriculture
Post Graduate Certificate in Dairy and Beef cattle management,2001.
- Katete secondary school, Katete, Zambia
GEC “O” Level School Certificate,1977.
- Presidents citizenship college, Kabwe , Zambia
Department of development
Certificate in integrated approaches to rural development,1983
- Palabana daily training institute, Lusaka , Zambia

Department of agriculture
Cert.in beef and dairy management,1986.

- Naivasha Dairy Training School,
Egerton University College and Teaching Techniques,Kenyatta University ,Kenya.
School of agriculture
Certificate in Milk Production,1987.
- University of Zambia ,Lusaka,Zambia
School of agriculture
Certificate in Principles and Practices in Animal Nutrition,1991.
- Institute Hawan Kluang, Malaysia
Agriculture section
Certificate in Artificial Insemination in cattle ,1992.

PROFESSIONAL MEMBERSHIP

Nil

ACADEMIC EMPLOYMENT HISTORY (*including Honorary and Adjunct Positions*)

- 1993-1997 Training officer, Palabana Institute ,Zambia.

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY HISTORY

- 1977-1980 agricultural supervisor, ministry of agriculture, food and fisheries, Lusaka, Zambia.
- 1981-1985 District agricultural .Ministry of agriculture, food and fisheries ,Lusaka, Zambia.
- 1985-1985 Animal husbandry ,Ministry of agriculture, food and fisheries ,Zambia.
- 1986-1992 Daily manager, palabana daily training institute, Zambia.
- 1972-1973 Hatchery Manager ,Hybrid poultry farm ,Zambia.
- 2003-2008 Principal, Palabana training institute and Mochipapa training center, Choma, Zambia.

RESEARCH INTERESTS

- Tropical Animal Production

- Livestock Sciences & Production

PUBLICATIONS (*last 5 years*)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	0	0

NAME: PHAROAH COLLINS SIANANGAMA

SCHOOL: School of Agriculture

CURRENT POSITION: Part Time Lecturer

COURSES TAUGHT

- Biometry
- Fundamentals of Animal Anatomy and Physiology
- Animal Biochemistry
- Applied Experimental Design and Analysis for Agricultural Research
- Animal Breeding
- Applied Animal Reproduction
- Animal Growth and Development

ACADEMIC QUALIFICATIONS

- 1999-1994- University of British Columbia, Vancouver, BC, Canada, Ph.D major: Animal Science (Reproductive Physiology)
- 1989-1990- University of British Colombia, Vancouver, BC, Canada, M.S.c major: Animal science (Reproductive Physiology)
- 1982-1986- University of Alexandria, Alexandria Egypt B.Sc Agr.(Hons) major: Animal Science
- 1976-1980- Kalomo Secondary School. Form V Cambridge School Certificate

ACADEMIC EMPLOYMENT HISTORY (*including Honorary and Adjunct Positions*)

- 2013-Date- Head-Department of Animal Science, Cchool of Agriculture sciences- University of Zambia

- 2013-Date-Lecturer-Department of Animal Science-University of Zambia
- 2009-2010-Sessional Lecturer-Lusaka college of Health Applied Sciences.
- 2006-2011-Sessional Lecturer-Rusangu university
- 2012-2013-Sessional Lecturer-university of Zambia- Animal Science Department
- 1994-1995-Sessional Lecturer-Animal Science Department-University of British Columbia

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY HISTORY

- 1990-1991-Laboratory Assistant-Animal care Centre-Canada
- 2007-2013-Head-Livestock and Pest Research Centre and Livestock Productivity and Disease Control Programme.
- 1986-2013-Scientific Officer-National Institute for Scientific and Industrial Research-Lusaka

PROFESSIONAL MEMBERSHIP

- Member, Zambia Academy of Sciences(ZaAS)
- Member, Agriculture Institute of Zambia of Zambia (AIZ)
- Member, Livestock Production Society of Zambia (LSPZ)
- Member, Agricultural Science Association of Zambia (ASAZ)
- Member, Society for the study of Reproduction (SSR)

RESEARCH INTERESTS

- Animal Anatomy
- Animal Physiology
- Animal Biochemistry
- Agricultural Research
- Animal Breeding
- Animal Reproduction
- Animal Growth and Development

PUBLICATIONS (last 5 years)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	13	0

NAME: JERAN PHIRI

SCHOOL: School of Agriculture

CURRENT POSITION: Part Time Lecturer

COURSES TAUGHT

- Introductory Mathematics
- Computer Skills

ACADEMIC QUALIFICATIONS

- **PhD Candidate with University of Free State, South Africa:** Currently pursuing Doctoral studies in Mathematics Education focusing on the teaching and learning of Algebra.
- **The University of Cape, South Africa (2012 – 2016)**
Completed the **Master of Education in Information Communication Technology Degree.**
- **The University of Notre Dame Australia, Fremantle:**
(16 February, 2004 - 12 December 2004).
The University of Zambia, Distance Education (1989 – 92)- Natural Sciences and Humanities.
- **The University of Zambia.** Full time studies (1993 – 94).
Qualification obtained: Bachelor of Arts with Education (**BA – Ed, Merit**), with a major in Mathematics and a Minor in English Language and Literature.
- **Copperbelt Secondary Teachers' College (1990)** Qualifications obtained: Advanced Secondary Teachers' Diploma in Mathematics (**Adv.Dip.Ed. - Merit**).

- **Copperbelt Secondary Teachers' College, Kitwe (1984 – 86).** Qualifications obtained: Secondary Teachers' Diploma in Mathematics (**Dip.Ed - Merit**).
- **Chikola Secondary School (1979 – 83).** Qualifications obtained: Junior Secondary School Leaving Examination Certificate.

PROFESSIONAL MEMBERSHIP

Nil

ACADEMIC EMPLOYMENT HISTORY (*including Honorary and Adjunct Positions*)

- **Copper belt University (1998 to January 2004).**

Part-time Lecturer taking a first year Technician's Construction class in Technical Mathematics and an Accountancy class in Business Mathematics and Statistics.

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY HISTORY

- **The University of Zambia, Distance Education (1989 – 92)- *Natural Sciences and Humanities.***
- **The University of Zambia.** Full time studies (1993 – 94).
Qualification obtained: Bachelor of Arts with Education (**BA – Ed, Merit**), with a major in Mathematics and a Minor in English Language and Literature.
- **Copperbelt Secondary Teachers' College (1990)** Qualifications obtained:
Advanced Secondary Teachers' Diploma in Mathematics (**Adv.Dip.Ed. - Merit**).
- **Copperbelt Secondary Teachers' College, Kitwe (1984 – 86).** Qualifications obtained: Secondary Teachers' Diploma in Mathematics (**Dip.Ed - Merit**).
- **Chikola Secondary School (1979 – 83)**
Qualifications obtained: Junior Secondary School Leaving Examination Certificate.

RESEARCH INTERESTS

- Mathematics
- Computer Science

PUBLICATIONS (*last 5 years*)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	0	0

NAME: FRANCIS MWANZA

SCHOOL: School of Agriculture

CURRENT POSITION: Lecturer

COURSES TAUGHT

- Animal Health

ACADEMIC QUALIFICATIONS

- Sokoine university of Agriculture, Morogoro, Tanzania
School of agriculture
Master of Science in public health and food safety, 2016.
- University of Zambia, Lusaka, Zambia
School of agriculture
Bachelor of veterinary medicine, 2008.
- St Mary's junior seminary, Chipata, Zambia
General certificate secondary education, 2000.

PROFESSIONAL MEMBERSHIP

Nil

ACADEMIC EMPLOYMENT HISTORY (*including Honorary and Adjunct Positions*)

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PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY HISTORY

- 2009 – Present Veterinary surgeon, Francofile Veterinary services, Chilanga, Lusaka.
- 2008-2009 Research assistant, Golden valley agriculture research trust, Southern province, Zambia.
- 2016-2016 District veterinary officer, ministry of agriculture and livestock, Zambia.
- 2013-2018 District focal point person, World Bank Sponsored Livestock development and animal health project, Chongwe, Zambia.
- 2016-Present District fisheries and livestock coordinator, Ministry of fisheries and livestock, Zambia.

RESEARCH INTERESTS

- Animal Health

PUBLICATIONS (*last 5 years*)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	0	0

NAME: NICHOLUS DANIEL

SCHOOL: School of Agriculture

CURRENT POSITION: Part Time Lecturer

COURSES TAUGHT

- Introduction to Chemistry
- Biochemistry

ACADEMIC QUALIFICATIONS

- Pursuing –Ph.D in Biochemistry –Govt Arts College
- January 2004- M.Phil. IN Biochemistry-Vinayanka Mision University
- April 2004- M.Sc in Biochemistry-M.I.E.T .Arts and sciences college-India
- April -2001- B.SC in Biochemistry-St. Joseph college of Arts and Science-India
- July -2003- PGDCA (Post graduate Diploma in Computer applications)
Annamalai University-India

PROFESSIONAL MEMBERSHIP

- Member of Teachers Association, Govt. Arts (Autonomous) college,
Kumbakonam,612001, Tamilnadu,India

ACADEMIC EMPLOYMENT HISTORY (including Honorary and Adjunct Positions)

- 2020-Date-Head of Department/lecturer-Mukuba University-Kitwe
- 2019-2020- lecturer-DMI-St.Eugene University-Chibombo
- 2018-2019- Vice Principle-Academic- DMI-St.Eugene University-Chipata
- 2017-2018-Head of Department- School of Education Science- DMI-St.Eugene University-Chipata

- 2016-2017-Teacher-RAAK International School-Pondicherry-India
- 2014-lecturer-Department of science-St Joseph University of Agricultural Science and Technology, Songea-Tanzania
- 2013-2014-lecturer-school of Busiines studies- St. John the Baptisit University, Mangochi-Malawi
- 2010-2012-lecturer- Department of Science-St Joseph University of Agricultural science -Tanzania

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY HISTORY

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RESEARCH INTERESTS

- Biochemistry
- Molecules

PUBLICATIONS (*last 5 years*)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	18	0

NAME: LIZZY MUZUNGAIRE

SCHOOL: School of Agriculture

CURRENT POSITION: Part Time Lecturer

COURSES TAUGHT

- Fundamentals of Aquaculture

ACADEMIC QUALIFICATIONS

- 2011-2013 – Vrije University Brussels (VUB) MSc Marine and Lacustrine Science and management.
- 2006-2009 - University of Namibia –Bachelors of science in Natural Resources Fisheries and Aquatic Sciences.
- 1959-1998- Natural Resources Development College –Diploma-Fisheries science.

PROFESSIONAL MEMBERSHIP

- Regional AIDS Training Network (RATN)
- Zambia Network of Environmental Practitioners (ZNEEP)

ACADEMIC EMPLOYMENT HISTORY (including Honorary and Adjunct Positions)

- 2000- June 2019- Acting Head of Department Fisheries Science Department-Natural Resources Development College (NRDC).
- 2000-June 2019- Training officer/lecturer Fisheries Science Department - Natural Resources Development College.

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY

HISTORY

- July 2019-update – Project Manager-World Fish-Zambia
- 2000- June 2019- Acting Head of Department Fisheries Science Department-Natural Resources Development College (NRDC).
- 2002- to date- Associate trainer- In Service Training Trust Lusaka

- 1999-2000- Farm Supervisor –Kalimba Fish Farm

RESEARCH INTERESTS

- Scientific Research

PUBLICATIONS (*last 5 years*)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	1	0

NAME: FRANCISCO KANYINJI

SCHOOL: School of Agriculture

CURRENT POSITION: Part Time Lecturer

COURSES TAUGHT

- Principles of Animal Nutrition
- Applied Animal Nutrition

ACADEMIC QUALIFICATIONS

- 2007 – 2010 : Ph.D. in Bio resources Science (Hiroshima University, Saijou, JAPAN)
- 2005 – 2007 : M.Sc. in Ruminant Nutrition (Hiroshima University, Saijou, JAPAN)
- 2004 – 2005: Postgraduate Diploma in Poultry Production (PTCPLUS, The NETHERLANDS)
- 1988 – 1993 : B. Agric. Sciences (The University of Zambia, Lusaka, ZAMBIA)
- 1985 – 1987 : Senior Secondary School Certificate (Lundazi Secondary School, ZAMBIA)
- 1982 – 1984 : Junior Secondary School Certificate (Lundazi Secondary School, ZAMBIA)
- 1976 – 1981 : Primary School Certificate (Eluhangeni Primary School, Lundazi, ZAMBIA)

ACADEMIC EMPLOYMENT HISTORY (*including Honorary and Adjunct Positions*)

- 2014 – To date: Lecturer II– Department of Animal Science, School of Agricultural Sciences, the University of Zambia, and Lusaka, ZAMBIA.
- 2011 – 2013: Head of Department - Animal Sciences Department, Natural Resources Development College, Lusaka, ZAMBIA.

- 2000 – 2011: Training Officer – Animal Science Department, Natural Resources Development College, Lusaka, ZAMBIA.

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY HISTORY

- 1994 – 2000: Farm Manager – Hybrid Poultry Farms Zambia Limited, Lusaka, ZAMBIA.
- May-July 2014 - Principal Trainer on a training course-World Vision InternationalKaoma Office.

PROFESSIONAL MEMBERSHIP

Nil.

RESEARCH INTERESTS

- Bioresources

PUBLICATIONS (*last 5 years*)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	11	0

NAME: LUCY NKHATA

SCHOOL: School of Agriculture

CURRENT POSITION: Part Time Lecturer

COURSES TAUGHT

- Communication Skills

ACADEMIC QUALIFICATIONS

- 2021-01 – 2021-04 World TESOL Academy, TESOL/TEFL (Teaching English to Speakers of Other Languages) Certificate
- 2016-11 – 2020-07 University of Zambia, MA in Linguistic Science
- 2008-06 – 2012-06: University of Zambia, Bachelor of Arts in Education (Englishmajor)
- 2001-01 – 2003-11: International Tutorial School, GCE School Certificate
- 1999-01 – 2000-11: Caritas Convent School, Junior Secondary School Certificate

PROFESSIONAL MEMBERSHIP

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ACADEMIC EMPLOYMENT HISTORY (<i>including Honorary and Adjunct Positions</i>)
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- 2017-01 – present: Teacher of English - Munali Girls Secondary School
- 2013-01 – 2016-01: Teacher of English - Kafue Boys Secondary School

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY HISTORY
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RESEARCH INTERESTS

- English

PUBLICATIONS (<i>last 5 years</i>)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	8	8

NAME: MTONGA TABONGO

SCHOOL: School of Agriculture

CURRENT POSITION: Lab Attender

COURSES TAUGHT

- Nil

ACADEMIC QUALIFICATIONS

- **2012 – 2012 – Durban University of Technology (D.U.T)**
Bachelor’s Degree – Bio-Technology –Durban, South Africa
- **2007-2010 – The University of Zambia –UNZA**
Bachelor’s Degree – Microbiology and Genetics – Lusaka, Zambia
- **2003-2005 – ST. Mary’s Secondary School, Zambia** Grade 12 School Certificate

PROFESSIONAL MEMBERSHIP

Nil

ACADEMIC EMPLOYMENT HISTORY (<i>including Honorary and Adjunct Positions</i>)
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- December 2010 – October 2011 – Trainee Laboratory Technician – National institute of scientific and Industrial Research (NISIR)

PROFESSIONAL EMPLOYMENT, EXPERIENCE AND CONSULTANCY HISTORY
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- September 2019- September 2021 – TOLL COLLECTOR – National Road Fund Agency.
- July 2013 – October 2016– Loan Officer- AB Bank Zambia, Lusaka.
- January 2012 – February 2013 - Research Student (Purification of water using nanoparticles) – Durban University of Technology (DUT) South Africa, Durban.

RESEARCH INTERESTS

-Nil

PUBLICATIONS (<i>last 5 years</i>)

Books	Book Chapters	Journal papers (refereed)	Conference papers (Refereed)
0	0	8	8

APPENDIX 3

Teaching Staff Register

BACHELOR OF ANIMAL SCIENCE AND PRODUCTION

COURSE ALLOCATION

Programme Coordinator: Mr. Collen Mweemba

FIRST YEAR: SEMESTER 1

COURSE CODE	COURSE NAME	LECTURER	QUALIFICATIONS	EMPLOYMENT STATUS(FT/PT)
MAT110	Introductory Mathematics	Mr. Jeran Phiri	(PhD) in Mathematical Education	PT
CHE120	Introductory Chemistry	Mr. Nicholas Daniel	MSc in Biochemistry	PT
BIO131	Introductory Biology	Mr. Lloyd Nsingo	M.Ed in Science	FT
COM141	Communication and Computer Skills	Communication Skills (Ms. Lucy Nkhata)	MA Linguistic Science	PT
		Computer Skills (Mr. Jeran Phiri)	(PhD) in Mathematical Education M.Sc in ICT	PT
ANS151	Introduction to Agriculture	Mr. Lastone C. C. Milambo	MSc. (Crop Science)	FT

FIRST YEAR: SEMESTER 2

COURSE CODE	COURSE NAME	LECTURER	QUALIFICATIONS	EMPLOYMENT STATUS(FT/PT)
MAT110	Introductory Mathematics	Mr. Jerani Phiri	(PhD) in Mathematical Education	PT
CHE120	Introductory Chemistry	Mr. Nicholas Daniel	MSc in Biochemistry	PT

AEC132	Farm Accounts & Introductory Agricultural Economics	Mr. Nicholas Obby Mainza	MSc in Agribusiness	FT
MAT142	Biometry	Dr. P.C. Sianangama	PhD in Animal Science	PT
ANS152	Introduction to Agricultural Botany	Mr. Lastone Milambo	Msc. (Crop Sciences)	FT

SECOND YEAR: SEMESTER 1

COURSE CODE	COURSE NAME	LECTURER	QUALIFICATIONS	EMPLOYMENT STATUS(FT/PT)
ANS210	Fundamentals of Animal Anatomy and physiology	Dr. P.C.Sianangama	PhD. (Animal Science)	PT
CHE221	Animal Biochemistry	Dr. P.C. Sianangama	PhD. (Animal Science)	PT
AEN231	Principles of Agro-Climatology	Dr. Ikabongo Mukubuta	PhD. (Soil Science & Environmental Resources)	FT
AEC241	Entrepreneurship and Innovation	Mr.Nicholas Obby Mainza	MSc. (Agribusiness)	FT
BIO251	Zoology	Mr.E.D Phiri	MSc. (Animal Science)	FT

SECOND YEAR: SEMESTER 2

COURSE CODE	COURSE NAME	LECTURER	QUALIFICATIONS	EMPLOYMENT STATUS(FT/PT)
ANS210	Fundamentals of Animal Anatomy and physiology	Dr. P.C.Sianangama	PhD. (Animal Science)	PT
AEN222	Farm structures	Dr. Ikabongo Mukubuta	PhD. (Soil Science & Environmental Resources)	FT
AEN232	Climate Change and variability	Dr. Ikabongo Mukubuta	PhD. (Soil Science & Environmental Resources)	FT
CSC242	Field Crop production	Mr. Brian Malambo	MSc. (Crop Production)	FT
AEC252	Farm Management	Mr. Nicholas Obby Mainza	MSc (Agribusiness)	FT
ANS262	Field Attachment I	Mr. Sondo Chanamwe	MSc. (Agriculture Extension & Rural Development)	FT

THIRD YEAR: SEMESTER 1

COURSE CODE	COURSE NAME	LECTURER	QUALIFICATIONS	EMPLOYMENT STATUS(FT/PT)
ANS311	Fundamentals of Aquaculture	Ms. Lizzy Muzungaire	MSc. (Marine & Lacustrine Science & Management)	PT
ANS321	Principles of Animal Nutrition	Dr. F. Kanyinji	PhD. (Animal Nutrition)	PT
ANS331	Animal Genetics	Mr. Collen Mweemba	MSc. (Animal Science)	FT
ANS341	Sheep, Goat and Rabbit Production	Mr. Collen Mweemba	MSc. (Animal Science)	FT

ANS351	Applied Experimental Design and Analysis for Agricultural Research	Dr. P.C. Sianangama	PhD. (Animal Science)	PT
ANS361	Field attachment II	Mr. Sondo Chanamwe	MSc. (Agriculture Extension & Rural Development)	FT

THIRD YEAR: SEMESTER 2

COURSE CODE	COURSE NAME	LECTURER	QUALIFICATIONS	EMPLOYMENT STATUS(FT/PT)
ANS312	Animal Health	Dr. Francis Mwanza	MSc (Public Health & Food safety)	PT
ANS322	Poultry Production	Mr. Collen Mweemba	MSc (Animal Science)	FT
ANS332	Animal Growth and Development	Dr. P. C. Sianangama	PhD. (Animal Science)	PT
ANS342	Applied Animal Nutrition	Dr. F. Kanyinji	PhD. (Animal Nutrition)	PT
ANS352	Pig production	Mr. E. D Phiri	MSc (Animal Science)	FT

FOURTH YEAR: SEMESTER 1

COURSE CODE	COURSE NAME	LECTURER	QUALIFICATIONS	EMPLOYMENT STATUS(FT/PT)
ANS441	Animal Breeding	Dr. P. C. Sianangama	PhD. (Animal Science)	PT
ANS421	Pasture Management and Forage Production	Mr. Brian Malambo	MSc. (Crop Production)	FT
ANS431	Beef Production	Mr. C. Mweemba	MSc. (Animal Science)	FT

ANS441	Aquaculture Production and Management	Ms. Lizzy Muzungaire	MSc. (Marine & Lacustrine Science & Management)	PT
ANS451	Applied Animal Reproduction	Dr. P. C. Sianangama	PhD. (Animal Science)	PT

FOURTH YEAR: SEMESTER 2

COURSE CODE	COURSE NAME	LECTURER	QUALIFICATIONS	EMPLOYMENT STATUS(FT/PT)
AEX412	Agricultural Extension and Rural Sociology	Mr. Sondo Chanamwe	MSc. (Agricultural Extension & Rural Development)	FT
ANS422	Range Management	Mr. C. Mweemba	MSc. (Animal Science)	FT
ANS432	Dairy Production	Mr. E.D Phiri	MSc. (Animal Science)	FT
ANS442	Animal Products and By-products	Mr. C. Mweemba	MSc. (Animal Science)	FT
ANS452	Research Project	Dr. P C. Sianangama	PhD. (Animal Science)	PT