CURRICULUM FOR MASTER OF SCIENCE (MSc) DEGREE
IN
ANIMAL NUTRITION

DEBRE BERHAN UNIVERSITY

COLLEGE OF AGRICULTURE AND NATURAL RESOURCE

DEPARTMENT OF ANIMAL SCIENCE

May, 2018

Debre Berhan, Ethiopia

TABLE OF CONTENT

List of Tables

1. INTRODUCTION

The livestock sector in Ethiopia is now considered as one of the key sectors in the broader economic development plans of the country. It has the potential to make a significant contribution to national economic growth, and job creation. In Ethiopia, rearing of livestock plays an important role in enabling livestock herders and farmers to have resilient livelihoods and to avoid both food insecurity and poverty. With rapid population and income growth, and increasing urbanization, the demand for livestock and livestock products is growing, presenting huge opportunities for the sector. Despite the potential, the livestock sector in Ethiopia is currently characterized by very low performance: poor productivity and limited market orientation, and low levels of commercial off-take (market supply) and competitiveness. Moreover, the level of contribution from the livestock sub-sector to the country's GDP and to the livelihood of the population is generally low compared to other African countries**.** This is largely reflected by low livestock productivity of local animals and this subsequently resulted in poor nutrition of local people, low local and export market income.

A roadmap for growth and transformation of Ethiopian livestock has been developed to improve the sector targeting in areas such as cow dairy development, red meat-milk and cattle feedlot development, poultry development, cow milk improvement, livestock feed production and extension, and livestock health improvement. However, under the present situation, poor nutrition and less feed processing facilities and low feeding management practices are some of the major constraints hampering livestock productivity in the country and producing well trained human resource in animal nutrition is one of the solutions for the current livestock production problem. Hence, to produce more qualified manpower, to satisfy the increasing demand of the population and to make sound income from the livestock sector, the Department of Animal Science of Debre Berhan University has proposed to open MSc programs in Animal Nutrition.

Masters of Science Degree in Animal Nutrition is a programme to build capacity in the application of science and technology in feed processing, feed formulation, nutrient metabolism, and dietary manipulation to influence product quality, health status, and nutrient losses to the environment. It is designed to adequately respond to the increasing demand for livestock products towards multi-objective approach to animal feeding to satisfy animal nutritional requirements as well as the

objectives of farmers, pastoralists and agro-pastoralists, millers, public authorities, environmentalists and consumers. The MSc in Animal Nutrition program consists of course work, graduate seminar, research, and writing a thesis that enable the student to cope or with stand in scientific way of investigation, the livestock sector problem. The coursework covers advanced aspects of Animal Nutrition, Animal Physiology, Biochemistry, Animal Biotechnology, Biostatistics and Research techniques in Animal Nutrition.

2. RATIONALE OF THE PROGRAM

Ethiopia is following agricultural-led-industrialization development program. This demands more professionals in the area of agriculture in general and animal science and technologies in particular. In line with the current development needs of the country, the educational policy of the Government of Ethiopia demands higher education institutions to be engaged in the production of graduates that are capable of creating jobs in their field of study and at the same time be able to respond to changing circumstances including market demands.

However, qualified professionals are scares compared with the number of technologies required to employment the growth and transformation plan of the country. Currently the country has faced animal feed scarcity both in quantity and quality, less feed processing facilities and low feeding management practices. These problems should be addressed through highly qualified professionals to increase the productivity of the livestock for the betterment of the livelihood of the population and for the increment of its contribution for the country's Gross Domestic Product.

3. OBJECTIVES

The objectives of this programme are:

- To equip students with knowledge and skills in animal nutrition and feed science, to enhance sustainable utilization of feed resources and improve animal productivity.
- To train students to undertake academic responsibility in teaching and consultancy in animal nutrition.

- Designing strategies, conduct problem-solving research related to animal nutrition and disseminate findings that could improve productivity, efficiency, and sustainability of animal agriculture and environmental sustainability

NEED ASSESSMENT

Need assessment study was conducted to get information about the importance of the new graduate program to be opened by the Department of Animal Sciences of Debre Berhan University. Individuals from different universities, colleges, industries, agricultural sectors, and other areas in Ethiopia were interviewed. None of the interviewees were against the program. About 89% of the interviewees were in favor opening the program by the Department by ranking first and second. Out of those who supported the opening of the program, about 65% of them reflected their need to get trained manpower in the area of Animal Nutrition. Generally, the study showed that there was strong interest among our potential stakeholders towards opening the postgraduate program.

4. STAFF PROFILE (Table 1)

Specialization	**Academic rank**		**On study leave**	**Total**
	Assistant professor	**MSc**		
Animal Nutrition	1		1	2
Animal production	2		5 PhD	7
Dairy Science	1			1
Animal Health	2			2
Animal Breeding and genetics	1			1
Total	7		6	13

In addition to the available staffs, it is easy to get guest lecturers when needed.

5. FACILITIES

Some text and reference books are already available in Debre Berhan University library. In addition, books will be purchased from the market and photocopied from other Universities. Laboratories for Dairy and Nutrition, Microbiology, parasitology and VPH are available with facilities not yet installed. The laboratory will be installed soon and be ready when the program is opened. There is also an opportunity to use animal nutrition laboratory and research facilities of Debre Berhan Agricultural Research Center which is located at the vicinity of the University.

6. PROFESSIONAL PROFILE

The graduates from this program will have a well-developed professional knowledge and skills on teaching, research and consultancy on sustainable livestock production and livestock feed production and processing industries. The graduate program emphasizes on research that increases the efficiency of animal production and feed resource utilization. Generally, graduates could be:

- Consult on identification, appraisal and planning of livestock development policies, projects and programs.
- Implement, manage and evaluate livestock feed development projects.
- Provide extension service in the dissemination of new applicable technologies related to animal feeds and feeding.
- Establish, manage and run private and commercial feed production and processing industries.
- Work as professionals in research institutions, private sector, government and non-government organizations and contribute to the development of the livestock sector.
- Monitor and evaluate animal feed resources and develop feeding systems.
- Provide training at Universities/Colleges and conduct researches.
- Develop a working document on balanced feed formulation for ruminant and non-ruminant animals.
- Develop a working document to establish national livestock feed production and feeding strategy.

7. GRADUATE PROFILE

After successfully completion of the program, the graduates are expected:

- To understand the need of animal nutrition enhancement for sustainable utilization of feed resources and animal productivity improvement
- To understand the major difference in nutrient utilization among different species of livestock
- acquire the skills needed for successful running of feed processing industries;

- To have capability in the application of advanced technology in feed conservation to improve livestock productivity
- To lay emphasis on the economic importance and contribution of livestock to the national economy
- To monitor and evaluate animal feed resources and develop feeding strategy.
- To cope themselves with the research method and scientific way of investigation of a given problem and to integrate, evaluate and finally provide innovate solutions for livestock production problems and;
- To work as successful professionals in private sectors, governmental and non-governmental organizations to contribute for the development of the livestock sector in the country

8. COURSEWORK

Coursework in the graduate program is designed to supplement the student's research capability and prepare the graduate for a professional career.

Animal nutrition classes focus on the nutrient composition of feedstuffs; nutrient metabolism; forage utilization; feed evaluation and processing technologies; mechanisms of growth; nutrient requirements for efficient production; animal metabolic disorders and manipulation of animal products to enhance human health. A current topic in animal nutrition helps students to expose to new advanced issues in animal nutrition. Nutrition classes are supplemented with courses in biochemistry, animal physiology, livestock economics, range sciences and biostatistics. Graduate seminar will offer to expose students to research in related areas and to the animal industries.

9. ADMISSION REQUIREMENT

Applicants with Bachelor degree (CGPA minimum of 2.0) in Animal Science, Biology, Biochemistry, Food Science or other related sciences (get approval by the department) from accredited higher learning institutions are illegible to join the program. Moreover, the applicant should full fill:

- must pass qualifying (entrance) examination in the field of study

- must be supported by at least three letters of recommendation preferably from the candidates under graduate instructors, employers and professional associations with a different background other than Animal Sciences may be required to take some prerequisite courses from the under graduate program. These courses will be worked out by the Department Graduate Council and approved by the Council of Graduate Studies of the university.
- The candidate should fulfil all the requirements of the graduate program and pass the entrance exam in good standing and score

The points (in percent) allotted to each criterion are depicted below.

The applicants can apply directly to the registrar office.

No.	Selection criteria	%
1	CGPA	45
2	Entrance examination	45
3	Service year and work experience to the intended field of specialization	10
4	Female applicant	5
	Total	**100%**

NB. If two students have equal points by the given criteria, the female students will be selected).

The application must include:

- transcripts from all universities attended (unofficial copies may be uploaded but if the candidate passed all the requirements and get accepted, official transcript should be submitted within a month after get registered)
- two letters of recommendation (can be submitted electronically)
- letter of sponsorship
- filled and signed application form of the university School of Graduate Studies

Action on admission will not occur until all documents have been received. If an applicant qualifies for admission, he/she will be informed by the Coordinator of college level graduate studies.

Applicants with a closely related Bachelor's degree

Applicants with a Bachelor's degree in Biology, Biotechnology, Veterinary Medicine or other related areas may also be admitted after assessing the courses they have taken. To be eligible, they should take courses identified by department counsel.

10. TIME OF APPLICATION, ENTRANCE EXAMINATION AND REGISTRATION

In each academic year, the time for application and entrance examination will be set by the University. Based on the decision of the Department Graduate Council and approval of the Council of Graduate Studies of the university, the candidate will be notified whether his/her application document is accepted or not in the same academic year. Newly accepted graduate students will be enrolled during the first semester of every academic year

11. DURATION OF THE STUDY

A regular graduate student is expected to complete all courses and thesis work within a minimum of two years in which students complete the course work in one year and complete their research in the following year/s depends on the nature of research. For extension students, 3 years residence is required, 2 years for course work and 1 year for research and defending. For summer students, the maximum duration of the study is 4 years out of which 3 years (3 summers) are allocated for course works and 1 year for conducting and defending the Research Thesis. In exceptional circumstance, the Department Council may waive the deadline mentioned above.

12. GRADUATION REQUIREMENT

The MSc degree in Animal Nutrition will be awarded to a candidate,

- Who has completed 31 credit hours course work and 6 credit hours of research, a total of 37 credit hours in the duration of the study.
- Who has satisfied the general graduation requirements, scored 'B' and above grade and only one 'C' grade in the examinations for the courses in the program with CGPA of 3.00 or more with no "D" or "F" or "NG" or "I".
- The students should successfully defend the MSc. thesis which will be awarded as excellent, very good, good and satisfactory depending on the quality of the research thesis and public defense.

13. DEGREE NOMENCLATURE

The name of the degree awarded after successfully completing is "**MSc. degree in Animal Nutrition**" in English and "**የእንስሳት ስነ-ምግብ**" in Amharic.

14. MODE OF COURSE DELIVERY

The teaching learning process of the program will be carried out through

- Lectures, laboratory work, visiting different farms, feed processing industries and institutes
- Term papers, seminar and course work projects presentation, and group discussion.
- Study course materials like books
- Relevant literatures (journal and proceedings)
- Using different audio-visual device and soft wares

15. METHOD OF TEACHING

The department will adopt active learning ways of approach for the transfer and/or acquisition of knowledge and/or skill based on the following methods.

- Classroom lectures
- Course-work projects
- Term papers with presentation
- Seminar presentation
- Practical and/or laboratory reports with presentation
- Educational tours and/or visits
- Group discussion;
- Demonstration;

16. ASSESSMENT AND EVALUATION METHODS

- The performances of the students will be assessed and evaluated continuously using practical work, individual assignments, Quizzes; Tests; Laboratory reports; Practical reports; Visit reports; Seminars; Attendances; presentations and examinations (midterm exam, final exam, and thesis oral defence examination etc.).
- Grades will be based on a total point system, where points are earned from various assessment methods in addition to formal examinations.
- Evaluation and assessment results will be shown to all students on time.

17. GRADING SYSTEM

The following grading system will be employed.

For course work

Raw	Letter	Grade Points	Status description	Class description
[90, 100)	A^+	4.00	Excellent	First Class with Great Distinction
[85, 90)	A	4.00		
[80, 85)	A^-	3.75		
[75, 80)	B+	3.50	Very good	First Class with Distinction
[70, 75)	B	3.0		
[65, 70)	B-	2.75	Good	First Class
[60, 65)	C+	2.50		Second class
[50, 60)	C	2.0	Satisfactory	
< 50	F	0.00	Failure	Fail

For thesis

All approved thesis will be evaluated as passed or failed. The board of examiners would rate the thesis defense as

Excellent = (86% and above),

Very good = (76-85%),

Good = (61-75%),

Satisfactory = (50-60%) and

Failure = (less than 50%) based on the merit of the thesis and oral defense.

If the final decision by the examiners board is poor, he/she will not get graduated unless additional work is done.

18. COURSES

18.1. Course list

18.1.1. Major area courses

Table 1. Major area courses

Course Code	Course Title	Cr.Hr.	Course ECTS	Contact hour	
				Lecture	Practical/lab /tutorial
ANNT 511	Forage Production and Range Management	3	5	2	1
ANNT 521	Monogastric Nutrition	3	5	3	0
ANNT 531	Advanced Biochemistry	3	5	3	0
ANNT 512	Ruminant Nutrition	3	5	3	0
ANNT 522	Analytical Techniques in Animal Nutrition	3	5	1	2
ANNT 532	Recent Topics in Animal Nutrition	1	1.5	1	0
ANNT 542	Research Methods and Scientific Writing	1	1.5	1	0
ANNT 552	Feed Processing and quality control	3	5	2	1
ANPR 511	Adaptation Physiology in Farm Animals	2	3.5	2	0
ANNT 621	MSc thesis	6	10	0	6

Note: Mode of delivery is semester bases.

18.1.2. Supportive Courses

Table 2. Supportive Courses

Course Code	Course Title	Cr.Hr.		Contact hour	
			Course ECTS	Lecture	Practical/lab /tutorial

ANPR 512	Milk production and processing (E)	3	5	2	1
ANPR 522	Meat production and Processing (E)	3	5	2	1
ANPR 542	Advanced Poultry production (E)	3	5	2	1
ANNT 552	Livestock value chain and marketing (E)	2	3.5	2	0

Note: Mode of delivery is semester bases.

19. COURSE CODE EXPLANATION

In the specialization of Animal Nutrition, each course code has a prefix ANNU followed by three-digit number. ANNU stands for the name of the department (Animal Nutrition). The course number is given based on the following sequence: The first digit of the course number represents the year in which the course is being offered, the middle number represent the sequence of the course being offered in the semester and the third digit represents the semester in which the course is being offered.

20. QUALITY ASSURANCE MECHANISMS

The quality of the program shall be audited in accordance with the guidelines set by Higher Education Relevance and Quality Agency (HERQA). Furthermore,

- Course outlines should be evaluated by Departmental Council and given to students at the beginning of each semester
- Prior to exam administration, the Departmental Exam Committee assess the standards of examinations
- Collecting feed backs from our graduates and employers regarding the quality of their performance
- Curriculum is subjected to internal and external evaluation when required by the college/university
- To keep the quality of the program the department will check available the necessary literature materials such as books, proceedings, journals, laboratory manuals and others

teaching materials and will follow up equipping laboratories with the necessary equipment and consumables.

21. DISTRIBUTION OF COURSES BY YEAR AND SEMESTER

The Animal Nutrition specialization offers the following courses for ***regular program***

Table 4. Year I Semester I

№	Code	Title	Cr. Hrs.
1	ANNT 511	Forage Production and Range Management	3
2	ANNT 521	Monogastric Nutrition	3
3	ANNT 531	Advanced Biochemistry	3
4	ANPR 541	Biostatics for Animal Science	3
5	ANPR 512	Milk Production and Processing (E)	3
6	ANPR 522	Meat Production and Processing (E)	3
		Total	**15**

E) = Elective course: Students are required to take at least one elective courses

Table 5. Year I Semester II

№	Code	Title	Cr. Hrs.
1	ANNT 512	Ruminant Nutrition	3
2	ANNT 522	Analytical Techniques in Animal Nutrition	3
3	ANNT 532	Recent Topics in Animal Nutrition	1
4	ANNT 542	Research Methods and Scientific Writing	1
5	ANNT 552	Feed Processing and Quality Control	3
5	ANPR 511	Adaptation Physiology in Farm Animals	2
6	ANPR 542	Advanced Poultry Production (E)	3
7	ANNT 552	Livestock Value Chain and Marketing (E)	2
		Total	**15/16**

E) = Elective course: Students are required to take at least one elective courses

Table 6. Year II

№	Code	Title	Cr. Hrs.
1	ANNT 611	Graduate Seminar	1
2	ANNT 621	MSc Thesis Research	6
		Total	**7**

Note: grades for MSc Thesis Research will be given as: Excellent, Very good, Good, Fair and poor. Therefore, if the final decision by the examiners board is poor, he/she will not get graduated unless additional work is done.

*The Animal Nutrition specialization offers the following courses ***For Weekend Program (Extension)***

Table 7. Semester I- Year I

№	Code	Title	Cr. Hrs.
1	ANNT 511	Forage Production and Range Management	3
2	ANNT 521	Monogastric Nutrition	3
3	ANNT 531	Advanced Biochemistry	3
		Total	**9**

Table 8. Semester II- Year I

№	Code	Title	Cr. Hrs.
3	ANNT 512	Ruminant Nutrition	3
2	ANNT 522	Analytical Techniques in Animal Nutrition	3
5	ANPR 511	Adaptation Physiology in Farm Animals	2
5	ANPR 541	Biostatics for Animal Science	3
		Total	**11**

Table 9. Semester III/Kiremit Semester/

№	Code	Title	Cr. Hrs.
2	ANNT 532	Recent topics in Animal Nutrition	1
4	ANNT 542	Research Methods and Scientific Writing	1
5	ANNT 552	Feed Processing and Quality Control	3
5	ANPR 512	Milk Production and Processing (E)	3
6	ANPR 522	Meat Production and Processing (E)	3
6	ANPR 542	Advanced Poultry production (E)	3
7	ANNT 552	Livestock value chain and marketing (E)	2
		Total	**10/11**

Table 10. Year II

№	Code	Title	Cr. Hrs.
1	ANNT 611	Graduate seminar	1
2	ANNT 621	MSc Thesis Research	6

	Total	**7**

*The Animal Nutrition specialization offers the following courses ***For Summer Program***

Table 11. Summer I

№	Code	Title	Cr. Hrs.
1	ANNT 511	Forage Production and Range Management	3
2	ANNT 521	Monogastric Nutrition	3
3	ANNT 531	Advanced Biochemistry	3
4	ANPR 541	Biostatics for Animal Science	3
5	ANPR 512	Milk Production and Processing (E)	3
6	ANPR 522	Meat Production and Processing (E)	3
	Total		**15**

Table 12. Summer II

№	Code	Title	Cr. Hrs.
1	ANNT 512	Ruminant Nutrition	3
2	ANNT 522	Analytical Techniques in Animal Nutrition	3
3	ANNT 532	Recent Topics in Animal Nutrition	1
4	ANNT 542	Research Methods and Scientific Writing	1
5	ANNT 552	Feed Processing and Quality Control	3
5	ANPR 511	Adaptation Physiology in Farm Animals	2
6	ANPR 542	Advanced Poultry Production (E)	3
7	ANNT 552	Livestock Value Chain and Marketing (E)	2
	Total		**15/16**

E) = Elective course: Students are required to take at least two elective courses

Table 13. Summer III-IV

№	Code	Title	Cr. Hrs.
1	ANNT 611	Graduate seminar	1
2	ANNT 621	MSc Thesis Research	6
	Total		**7**

22. COURSE DESCRIPTION

Course title:	**Biostatistics for Animal Science**
Course code:	ANPR 541

Credit hour:	**3 (2+1)**

Principles of experimental design as introductory. Methods for analysis of variance with one and two levels of randomization, regression and model fitting. Other topics include ANOVAs with blocking, factorial designs, Latin Square, Split plot, changeover, repeated measures and unbalanced designs. Practical issues such as missing data and analysis will be covered. Introduction to statistical packages and computer exercises will be given in mostly SAS package. Students will be expected to write code for particular designs and interpret output. They will be required to start with design and layout through to analysis and interpretation. Other statistical software packages may be used on occasions for demonstration purposes such as SPSS.

Learning Outcomes

Upon successful completion of this subject, students should:

be able to judge and justify whether the statistical methodology and conclusions drawn in the media and scientific papers are appropriate;

be able to use a statistical package to: summarize data graphically and numerically, analyze data appropriately, and interpret and present the output in a clear logical manner;

be able to explain the concepts of statistical inference, regression and correlation, and apply these to confidence intervals and tests of hypotheses;

be able to evaluate if the assumptions underlying statistical techniques are valid in a given scenario;

be able to compare standard experimental designs, determine appropriate sample sizes and justify randomization and blocking;

be able to appraise a scientific problem and develop a statistical solution to that problem

Course outline

1. PRINCIPLES OF FIELD EXPERIMENTATION AND DESIGNS

1.1. One factor experiments

1.1.1. Completely Randomized Design

1.1.2. Randomized Block Design

1.1.3. Latin Square Design

1.1.4. Switchover Design

1.2. Two factor experiments

1.2.1. Introduction and factorial concept

1.2.2. Split-Plot Designs

2. PAIRWISE COMPARISON BETWEEN TREATMENT MEANS

2.1 Planned and unplanned comparisons

2.2 Least Significant Difference (LSD)

2.3 Duncan's Multiple Range Test (DMRT)

3. MODELS AND VARIANCES

Analysis of variance

Assumptions of analysis of variance and their tests

Different animal models used in analysis of variance

Alternatives in case of failure of assumptions

Analysis of co-variance (MANCOVA)

Variance component estimation

4. SAS AND SPSS SOFTWARE APPLICATIONS

Data organization for different animal species and their management

Analyzing the data using SAS and SPSS

Writing full paper using the analyzed data

References:

Morris, T.R. 2002. Experimental Design and Analysis in Animal Sciences

Kaps, M. 2004. Biostatistics for Animal Science

Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Research. 2nd ed. John Willey and Sons. Inc. New York

Hoshand, A.R. 2004. Experimental Research Design and Analysis: A Practical Approach for Agriculture and Natural Science. CRC Press

Snedecor and Cochran, 1980. Statistical Methods. Iowa/Blackwell.

Course title:	Adaptation Physiology in Farm Animals
Course code:	**ANPR 511**
Credit hour:	**2 (1+1)**
Description: Physiology of circulatory, digestive, respiratory, urinary, neuro-muscular, and reproductive systems of important domestic animals. The direct and indirect effects of physical	

factors on physiological process and productivity of animals. Bio-climatic effect on growth, production and reproduction of livestock. Fluid and electrolyte balance, acid-base balance. Thermoregulation, acclimation and acclimatization to different environmental conditions. Analysis of mechanisms of adaptation to direct and indirect environmental stress of animals.

Course Content

1. Introduction
   1.1. General concept on the anatomy and physiology of domestic animals
   1.2. Definition of terminologies
2. Physiology of domestic animals
   2.1. Circulatory systems
      2.1.1. Heart
      2.1.2. Blood vessel
      2.1.3. Pulmonary and systemic circulation
      2.1.4. Blood
   2.2. Respiratory systems
      2.2.1. Parts of the respiratory system
      2.2.2. Pumping Apparatus
      2.2.3. Mechanism of pulmonary ventilation (Breathing)
      2.2.4. Muscles of breathing
      2.2.5. Pulmonary volumes and capacities
      2.2.6. Exchange of air between alveoli and capillaries
      2.2.7. Regulation of breathing
   2.3. Urinary systems
      2.3.1. Urine
      2.3.2. Organs of urination
      2.3.3. Urineferous tubule
      2.3.4. Function of each component of the nephrone
   2.4. Neuro-muscular systems
      2.4.1. Division of nervous system based on location / anatomy
      2.4.2. Ventricles and cerebro spinal fluid

2.4.3. Neuron

2.4.4. Nerve message

2.4.5. Synapses

2.4.6. Neurotransmitter

2.4.7. Types of muscle

2.4.8. Composition of muscle fiber

2.4.9. Muscles found on different body parts

2.5. Reproductive systems

2.5.1. Male reproductive organs

2.5.2. Spermatogenesis

2.5.3. Female reproductive organs

2.5.4. Oogenesis

2.5.5. Mammary gland

3. Effects of physical factors on

3.1. Physiology of domestic animals

3.2. Reproduction of domestic animals

3.3. Production of domestic animals

4. Bio-climatic effect on growth, production and reproduction

5. Thermoregulation, acclimation and acclimatization to different environmental conditions

6. Analysis of mechanisms of adaptation to direct and indirect environmental stress of animals.

7. Physiological Adaptation of Animals to Hot Environment

the physiology of farm animals

structural and functional adaptations in farm animals,

Homeostasis, physiological, biological and genetic adaptations

Coordination of responses to an animal's internal and external environment by nerves and hormones,

Environmental stress affecting farm animals productivity and reproduction

- **References**:

1. Frandson, R.D., W. Lee, and Anna Dee Fans. 2003. Anatomy and Physiology of Farm Animals. 6th ed. Blackwell Publishing.

2. Heath, E. 1985. Anatomy and Physiology of Tropical Livestock
3. Nagabhushana, M. 2002. A Text Book of Animal Physiology.2nd ed.
4. Ian, K. 1999. Introduction to Animal Physiology. Bios Scientific.

Course Title: Advanced Biochemistry

Course code ANNT 561
Lecture: 3 (2+1)

Description: Animal cell, ultra structure of the cell, cell membrane, structure and function of bio-molecules (protein-hemoglobin; lipids-membranes; carbohydrate-peptidoglycans; etc.). Metabolism, (carbohydrate, protein, lipid); including photosynthesis and organ specialization. Integration of carbohydrate, protein and lipid metabolism and regulation. Vitamins, enzymes, coenzymes and mineral metabolism. Biosynthesis of macromolecules. Rumen metabolism. Fate of different nutrients in the rumen. Milk synthesis. Metabolic diseases (ketosis, milk fever, pregnancy toxemia etc.).

Course content

1. Introduction: Definitions of some terminologies
2. Animal cell:
   2.1. Ultra structure of the cell and cell membrane
   2.2. Organ specialization
3. Structure and function of bio-molecules
   3.1. Protein-hemoglobin;
   3.2. Lipids-membranes;
   3.3. Carbohydrate-peptidoglycans.
4. Metabolism,
   4.1. Carbohydrate metabolism
   4.2. Protein metabolism
   4.3. Lipid metabolism
   4.4. Integration of carbohydrate, protein and lipid metabolism and regulation
   4.5. Vitamins metabolism

4.6. Enzymes and coenzymes metabolism

4.7. Mineral metabolism.

5. Rumen metabolism

6. Milk synthesis

7. Metabolic diseases

7.1. Ketosis

7.2. Milk fever

7.3. Pregnancy toxemia

Reference

Moran, 1994. Biochemistry. 2nd edition.

A.V.S.S. Rama Rao, 2002. A text book of biochemistry. 9th edition.

Horton R.H, et al. (1993). Principle of biochemistry. Neil Patterson publisher's prentice-hall.

Course title:	**Livestock value chain and marketing (E)**
Course code:	ANNT 552
Credit hour:	**2 (2+0)**

This course deals with the Livestock resources, economics importance of livestock to the national economic theory applied to livestock production. Allocation of factors of production and profit maximization, farm planning and budgeting (economics of animal feeds and feeding, consumption and output relationship, aggregate demand and supply, economic planning and evaluation of diseases, price analysis in diseases control); farm accounts and accounting analysis. Demand for and supply of livestock and livestock products. Marketing system; channels costs and margins problems and obstacles in livestock marketing livestock resource development in Ethiopia

Learning Outcomes

Upon successful completion of this subject, students should

Be able to explain the livestock value chain and marketing systems in Ethiopia.

Be able to analyze the economics of livestock keeping in commercial as well as smallholder systems

Be able to design efficient marketing systems of livestock in Ethiopia

Course outline

Definition of livestock value chain and marketing

economics importance of livestock to the national economic

Allocation of factors of production and profit maximization,

farm planning and budgeting

Farm accounts and accounting analysis.

Demand for and supply of livestock and livestock products.

Marketing system; channels costs and margins problems and obstacles in livestock marketing

livestock resource development in Ethiopia

Course Title: Monogastric Nutrition

Course code: ANNT 521
CrHr: 3 (3+0)

Description: Comparative gastro-intestinal digestion and metabolism of nutrients in poultry, pig, horse, and rabbit; measurement of energy value; energy requirement; role of protein quality and requirements; role of vitamins, mineral, enzymes feed additives for mono-gastric; feed resources and formulation of rations for mono-gastric animals; feeding methods for the different classes of poultry, pig, horse and rabbit.

Course Content

1. Introduction
   1.1. Definitions of some terminologies
   1.2. Anatomy of the digestive systems of mono-gastric animals
2. Feed digestion and absorption in mono-gastric animals
   2.1. Gastro-intestinal digestion of nutrients
   2.2. Metabolism of nutrients
3. Function of feeds and feeding standards
   3.1. Measurement of energy value energy requirement
   3.2. Role of protein quality and requirements
   3.3. Role of vitamins and requirements
   3.4. Role of mineral and requirements

3.5. Role of enzymes

3.6. Role of feed additives

4. Feed resources and ration formulation

4.1. Types of feeds for mono-gastric animals

4.2. Ration formulation

4.2.1. Ration formulation for poultry

4.2.2. Ration formulation for pig

4.2.3. Ration formulation for horse

4.2.4. Ration formulation for rabbit

References:

McDonald, et.al.1995. Animal Nutrition

Cheeke, P. R. 1999. Applied Animal Nutrition: feeds and feeding

Pond, W.G. D.C.1995. Basic Animal Nutrition and Feeding

Tisch, D. 2005. Animal Feeds, Feeding and Nutrition, and Ration Evaluation

Kundu, S.S, Singh, S., Mahanta, S.K. and Pailah, G.H.2005. Feeding Farm Animals. Satish Serial Publishing House

Course Title: Ruminant Nutrition

Course code: ANNT 512
CrHr: 3 (3+0)

Description: The ruminant and its environment; anatomy and function of ruminant GIT; microbes in the gut; voluntary feed intake, rumen fermentation of carbohydrates, nitrogen, lipids and products; kinetics of rumen function; methano-genesis, effects and control; interrelations between feeding and productivity of ruminants; Nutritional disorders in ruminants.

Course Content

1. Introduction

1.1. Definitions of some terminologies

1.2. Anatomy and function of ruminant gastro intestinal tract

1.3. Ruminant and its environment

2. Microbes in the gut
3. Voluntary feed intake
4. Feeds and feeding
   4.1. Rumen fermentation of carbohydrates,
   4.2. Rumen fermentation of protein,
   4.3. Rumen fermentation of lipids
   4.3. Kinetics of rumen function;
      4.3.1. Methano-genesis,
      4.3.2. Effects and control;
5. Interrelations between feeding and productivity of ruminants;
6. Nutritional disorders in ruminants.

References:

McDonald, et.al.1995. Animal Nutrition

Cheeke, P. R. 1999. Applied Animal Nutrition: feeds and feeding

Pond, W.G. D.C.1995. Basic Animal Nutrition and Feeding

Tisch, D. 2005. Animal Feeds, Feeding and Nutrition, and Ration Evaluation

Kundu, S.S, Singh, S., Mahanta, S.K. and Pailah, G.H.2005. Feeding Farm Animals. Satish Serial Publishing House

Course Title: Analytical Techniques in Animal Nutrition

Course code: **ANNT 522**

CrHr: 3 (1+2)

Description: This course gives an overview on analytical procedures from sampling, laboratory sample preparation techniques, measurements and calculations to the final reporting of results. Proximate and detergent nutrient analysis of water, dry matter and gross energy; fiber components; macro- and micro-minerals analysis; determination of nutrient digestion in animals

Course Outline

1. Collection, processing and preservation of representative samples for analysis

2. Determination of proximate principles
3. Determination of cell wall fractions
4. Determination of the gross energy in biological materials
5. Mineral determination in feed stuffs, faeces, urine and other biological materials
6. Anti-nutritional factors in feed
7. Feed evaluation

References:

Owosu-Apenten R. 2005. Introduction to food chemistry. Boca Raton, CRC Press. 249 p. ISBN 0-8493-1724-X.

Skoog D.A., West D.M., F.J. Holler.1997. Fundamentals of analytical chemistry. Fort Worth, Saunders Colledge Publishing: ISBN 0-03-05938-0.

Skoog D.A. 1998. Principles of instrumental analysis. Fort Worth, Saunders Colledge Publishing: 849 p. ISBN 0-03-002078-6.

Nollet L.M.L. 1998. Handbook of food analysis. New York, Marcel Dekker, Inc.:2041 p. ISBN 0-8247-9683-7

Course Title: Forage Production and Range Management

Course code: **ANNT 511**

CrHr: 3 (2+1)

Description: Objectives of pasture and range management; difference between native and improved grasslands; highland and lowland production systems; the potential and role of forage production; influence of climate on production objectives; foraging theory: relationships between forage quantity, quality and maturity versus animal output; production versus forage utilization; important forage crops (cereals, grain legumes, forage grasses, forage legumes, trees/shrub legumes); important native and improved forage crops; importance of legumes in pastures; morphological response to grazing or browsing;. Management of forage resources: fertilization; over sowing, stocking rates, herd structures, communal and commercial grazing strategies; Principles of Grassland and Range management. Economics of pasture and range management

Course Content

1. Introduction
   1.1. Definitions of forage, pasture and rangelands
   1.2. Objectives of pasture and range management
   1.3. difference between native and improved grasslands
2. Forage production systems
   2.1. Highland forage production systems
   2.2. Lowland forage production systems
   2.3. Influence of climate on production objectives
   2.4. Potential and role of forage production
3. Foraging theory:
   3.1. Relationships between forage quantity, quality and maturity versus animal output;
   3.2. Production versus forage utilization;
5. Improved forage production and utilization strategies
   4.1. Improved forage production strategies
      4.1.1. Backyard forage production
      4.1.2. Under-sowing and inter-planti4g
      4.1.3. Contour forage strips
      4.1.4. Over-sowing
      4.1.5. Stock exclusion areas/fodder banks
      4.1.6. Cultivation of improved forage crops
         4.1.6.1. Principles for selection and testing of improved forage crops
         4.1.6.2. Potential improved forage crops
5. Range Management
   5.1. Rangeland definition, importance, and utilization systems
   5.2. Range management and its relation to other sciences
   5.3. Systems of range management
   5.4. Rangeland degradation and the role of range management
6. Range Utilization, Condition, and Trend Analysis
   6.1. Utilization measurements
   6.2. Problems associated with estimates of utilization

6.3. Range condition assessment approaches

6.4. Range trend determination

7. Range Vegetation Rehabilitation and Improvement Methods

7.1. General considerations in rehabilitating rangelands

7.2. Rehabilitating methods

7.2.1 Seeding/reseeding

7.2.2 Grazing management and development of water points

7.2.3 Control of bush encroachment

8. Economics of pasture and range management

References:

Alemayehu Mengistu, 1987. Conservation Based Forage Development. Addis Ababa, Ethiopia.

Humphyreys, L.R. 1987.Tropical Pasture and Fodder Crops. 2nd ed.,I.I.A.S., Longman.

Course Title: Feed processing and quality control

Course code: **ANNT 531**

CrHr: 3 (1+2)

Description: Definition, procurement, storage and care of raw materials, identification of feed adulterants, methods of feed processing (chemical, physical, biotechnological); feed preservation techniques (silage making hay making etc.); preserving roots and tubers; feed laws and regulations; quality control of raw and finished products.

Course Content

1. Definition of some terminologies

2. Procurement, storage and care of raw materials

3. Identification of feed adulterants,

4. Methods of feed processing

4.1. Chemical processing of feeds

4.2. Physical processing of feeds

4.3. Biotechnological processing of feeds

5. Feed preservation techniques

5.1. Silage making

5.2. Hay making and quantity estimation

5.3. Preserving roots and tubers

6. Feed laws and regulations

7. Quality control of raw and finished products.

References:

Owosu-Apenten R. 2005. Introduction to food chemistry. Boca Raton, CRC Press. 249 p. ISBN 0-8493-1724-X.

Skoog D.A., West D.M., F.J. Holler.1997. Fundamentals of analytical chemistry. Fort Worth, Saunders Colledge Publishing: ISBN 0-03-05938-0.

Skoog D.A. 1998. Principles of instrumental analysis. Fort Worth, Saunders Colledge Publishing: 849 p. ISBN 0-03-002078-6.

Nollet L.M.L. 1998. Handbook of food analysis. New York, Marcel Dekker, Inc.:2041 p. ISBN 0-8247-9683-7

Course title:	**Milk Production and Processing**
Course code:	**ANPR 512**
Credit hour:	**3 (2+1)**

Milk production - national and international situation. Role of cattle, Camel, Goat and Sheep. Milk production systems in the tropics. Recent practices of optimizing immune-competency of young stock, growth rate and puberty. Pre and post parturition practices to maximize reproduction and milk production. Principles of replacement and culling. Housing, equipment and management in warm climate. Modern milking management- milking method, milk quality, handling and marketing. Maintenance of herd health and productivity. Small and large scale commercial dairying- project proposal, establishment and expansion. Administration- technical and financial records. Efficient utilization of land, labour, feed and fodder. Technical and financial evaluation of dairy enterprise.

Learning Outcomes

Upon successful completion of this subject, students should:

Be able to describe how milk is produced and how it is affected

Be able to deliver good management techniques for milking animals at different stages

Be able to apply the reproductive principles to control reproductive wastage in animals;

Be able to evaluate the reproductive potential and evaluate factors that limit reproduction and develop management strategies to improve fertility;

Be able to manage dairy farms and develop dairy project proposal for small and large scale farms

Course content

1. Introduction

1.1. Milk production (national and international situation).

1.2. Role of cattle, camel, goat and sheep in milk production

1.3. Milk production systems in the tropics

1.4. Growth rate and puberty of milk cattle

1.5. Pre and post parturition practices to maximize reproduction and milk production

1.6. Principles of replacement and culling

1.7. Housing, equipment and management in warm climate.

2. Dairy building, design and construction

2.1. Site selection

2.2. Type of building

2.3. Arrangement and installation of equipment

3. Milk as food

4. Milk constituents or composition

5. Factors affecting milk composition

5. 1. Milk chemistry

5.2. Physical status of milk

6. Milk and butter microbiology

7. Clean milk production and source of contamination

8. Milk processing and hygiene

8.1. Milk separation

8.2. Butter making with fresh milk or cream

8.3. Butter making with sour whole milk

8.4. Ghee, butter oil and dry butter fat

8.5. Cheese making using fresh milk

8.6. Cheese making with sour skim milk

8.7. Milk fermentation

9. Cleaning of equipment

9.1. Dairy water supply

9.2. Chemicals used for cleaning

9.3. Cleaning procedure

10. Sampling and analysis of milk, milk products and water

10.1. Sampling

10.2. Measuring milk pH

10.3. Titratable acidity test

10.4. Alcohol test

10.5. Clot-on-boiling test

10.6. Fat determination

10.7. Specific gravity of milk

10.8. Total solids (TS) in milk

10.9. Formaldehyde in milk

10.10. Methyline blue reduction test

10.11. Sediment or visible dirt test

10.12. Moisture content of butter

10.13. Salt content of butter

Course title:	**Meat Production and Processing**
Course code:	**ANPR 522**
Credit hour:	**3 (2+1)**

Diversity of meat sources and consumption; description and evaluation of various meat production systems. Constraints for improvement of meat production in tropics. Improvement through range, feedlot, nutrition, management and breeding of cattle, camel, sheep and goat. Physical evaluation of slaughter animals. Carcass and meat characteristics and quality evaluation. Meat as a product and factors affecting meat. Live animals, meat and meat product trade and marketing

Learning Outcomes

Upon successful completion of this subject, students should:

Be able to describe the different meat production systems found in the country

Be able to explain how meat is produced and how it is affected by different management systems

Be able to recommend different management techniques for small scale meat production and commercial feedlots

Be able to identify between the good and bad quality meat and describe the local and international marketing systems of meat

Course Content

1. Meat consumption and contribution of meat to human
2. Constraints for improvement of meat production in tropics.
3. Feeds and feeding
3.1. Improvement through range
3.2. Improvement through feedlot
4. Slaughtering and slaughtering procedures
4.1. Ante-mortem handling and welfare
4.2. Procedures in slaughtering
4.3. Stunning and bleeding
4.4. Skinning of cattle and small ruminants
4.5. Evisceration
4.6. Splitting, washing and dressing of carcasses
4.7. Refrigeration and handling carcasses
5. Meat Evaluations and Grading
5.1. Carcass yield, quality and composition
5.2. Meat quality and quality evaluation
6. Factors affecting meat quality
7. Live animals, meat and meat product trade and marketing

References:

Gunter Heinz and Peter Hautzinger, 2007. Meat processing technology: for small- to medium scale producers. Food and agriculture organization of the United Nations regional office for Asia and the Pacific Bangkok, 2007

John St. and Clottey A. 1985. Manual for the slaughter of small ruminants in developing countries. FAO animal production and health paper 49. Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla, 00100 Rome, Italy.

Guidelines for slaughtering, meat cutting and further processing. FAO animal production and health paper 91. Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla, 00 100 Rome, Italy.

Course title:	**Advanced Poultry Production**
Course code:	**ANPR 542**
Credit hour:	**3 (2+1)**
Current issues and prospects of commercial layer and broiler poultry farms in tropics. Physiology of egg formation and oviposition. Hatching eggs and hatchability. Hatchery equipment, operation, incubation and hatchery management. Commercial scale management of chicks, replacement pullets, layers and broilers. Environment, housing, equipment and waste management. Components of poultry feed, nutrient requirement and monitoring of feed. Health management - control of poultry diseases and parasites. Poultry breeding, record keeping, production of parental stock and hybrids, Chick sexing and grading. Poultry and poultry product processing, Egg as a product-quality, grading and marketing. Broiler birds - marketing live and processed birds. Economics of egg and broiler meat production.	
Learning Outcomes Upon successful completion of this subject, students should: Be able to describe how egg is produced and how it is affected Be able to explain the management systems required for small scale nd commercial poultry production Be able to use appropriate grading systems to select quality egg and related products for large scale commercial poultry farms Be able to explain the economics of poultry production for eggs and meat or both Be able to establish disease-free poultry farms	
Course Content 1. Introduction to Poultry Production 1.1. Definitions and terminologies in poultry production 1.2. Economics of egg and broiler meat marketing	

1.3. Poultry production systems

1.4. Current issues and prospects of commercial layer and broiler poultry farms in tropics.

2. Incubation and Hatchery Management

2.1. Physiology of egg formation and oviposition

2.2. Hatching eggs and hatchability.

2.3. Hatchery equipment, operation, incubation and hatchery management

3. Poultry breeding,

3.1. Production of parental stock and hybrids

3.2. Chick sexing and grading

4. Egg management and marketing

4.1. Keeping quality of egg,

4.2. Egg grading systems

4.3. Egg processing and marketing.

5. Broiler birds

5.1. Marketing of live birds

5.2. Marketing of processed birds.

6. Commercial scale management of chicks, replacement pullets, layers and broilers.

7. Environment, housing, equipment and waste management.

References:

1. Rose, S.P. 1996. Principles of Poultry Science. Cabi publishing

2. Malren, C.N. 1987. Poultry Production in the Tropics.

3. Morley, J. A.. 2001. Successful Poultry Management. Biotech Books, Delhi.

4. Ensminger, M.E. 2002. Poultry Science. Prentice Hall.

Course title:	**Research methodology and scientific writing**
Course code:	ANNT 542
Credit hour:	**1 (1+0)**

Definition of research, defining research problems, identifying and prioritizing research needs, principles of research, steps in scientific research, types of research, sampling and data collection methods, purposes of writing proposal, general components of a research proposal and scientific papers like introductory section, review of related literature, materials and

methods, work plan and budget, bibliography/literature citations, Data analysis and presentations, introduction of statistical Softwares, Discussion on sample proposals and papers.
Learning Outcomes Upon successful completion of this subject, students should: Be able to prepare research protocol following the standard procedures Be able to conduct research using the best design and procedures. be able to analyze the data using appropriate statistical methods and write scientific papers
Course outline principles of research procedures of preparing protocol procedures of scientific paper writing data presenting in scientific paper reputable journals in animal science

Course title:	**Recent Topics in Animal Production**
Course code:	**ANNT 542**
Credit hour:	**1 (0+1)**
Seminar on advanced topics, new developments and special problems in the area of animal production will be prepared and presented by graduate students. The seminars should be prepared from recent and the topics must be approved by the DGC	
Learning Outcomes Upon successful completion of this subject, students should: Be able to synthesize and write different review papers based on recent literatures and findings in the area of animal science Be able to confidently present different seminars at national and international forums. be able to demonstrate verbal and written skills relevant to advanced studies	

Course title:	**Graduate Seminar**
Course code:	**ANNT 611**

Credit hour:	**1 (0+1)**
Results of MSc Thesis will be briefly presented by students in the form of a seminar before an open defense. The major research advisors will organize seminars and evaluate the students	
Learning Outcomes Upon successful completion of this subject, students should: Be able to confidently present different seminars at national and international forums. be able to demonstrate verbal and written skills relevant to advanced studies be able to demonstrate an advanced level of knowledge in the area of specialization,	

Course title:	**Research Thesis**
Course code:	**ANNT 621**
Credit hour:	**6 (0+6)**
Independent research planned, conducted, and reported in the area of animal production in consultation with advisors. The research is designed to include thesis proposal defense thesis presentation and open defense as a partial requirement for the MSc degree.	
Learning Outcomes Upon successful completion of this subject, students should: be able to demonstrate knowledge and skills relevant to conducting research, especially for entry to higher degree courses; be able to demonstrate an advanced level of knowledge in the area of specialization, and be able to demonstrate verbal and written skills relevant to advanced studies	

23. REFERENCES

AAPBMDA (Animal, Animal Products and By-products Market Development Authority). 1999. Market problems and measures to be taken. AAPBMDA. Addis Ababa, Ethiopia.

Debre Markos University, School of Graduate studies, MSc curriculum.

Haramaya University, School of graduate studies, MSc curriculum.

Hawassa University, School of graduate studies, MSc curriculum.

MEDAC (Ministry of Economic Development and Cooperation). 1998. Survey of livestock and fisheries development. MEDAC Agricultural Development Department, Livestock Team, Addis Ababa, Ethiopia.

Wolaita Sodo University, School of graduate studies, guideline to graduate programs. 2013. Wolaita Sodo.