



**DEBRE BERHAN UNIVERSITY**  
**COLLEGE OF AGRICULTURE AND NATURAL RESOURCE**  
**DEPARTMENT OF ANIMAL SCIENCE**

**CURRICULUM FOR MASTER OF SCIENCE (MSc) DEGREE IN**  
**ANIMAL PRODUCTION**

**May 2018**  
**Debre Berhan**

## Table of Contents

1. BACKGROUND AND RATIONALE.....	2
2. NEED ASSESSMENT .....	3
3. OPPORTUNITIES.....	4
3.1. Staff qualification.....	4
3.2. Facilities .....	4
3.3. Location advantage .....	5
4. PROGRAM OBJECTIVES .....	5
5. PROFESSIONAL PROFILE .....	6
6. GRADUATE PROFILE .....	6
7. MODE OF DELIVERY AND TEACHING METHODS .....	8
8. ASSESSMENT AND EVALUATION METHODS .....	9
9. GRADING SYSTEM .....	9
10. DURATION OF STUDY .....	10
11. ADMISSION REQUIREMENTS .....	10
12. TIME OF APPLICATION, ENTRANCE EXAMINATION AND REGISTRATION.....	12
13 GRADUATION REQUIREMENTS .....	12
14. QUALITY ASSURANCE MECHANISMS .....	12
15. DEGREE NOMENCLATURE.....	13
16. TOTAL COURSES .....	13
17. COURSE LIST FOR REGULAR PROGRAM.....	14
18. COURSE LIST FOR SUMMER PROGRAM .....	14
19. COURSE LIST FOR EXTENSION PROGRAM .....	15
20. COURSE DESCRIPTIONS AND OUTLINES .....	16

## List of Tables

Table 1. Grading system .....	9
Table 2. selection criteria .....	11
Table 3. Total course lists .....	13
Table 4. Year I; Semester I Regular Program course .....	14
Table 5. Year I; Semester II Regular Program course .....	14
Table 6. Year II; Semester I Regular Program course .....	14
Table 7. Year I; Semester I Summer Program courses .....	14
Table 8. Year I; Semester II Summer Program courses.....	15
Table 9. Year II; Semester I Summer Program courses.....	15
Table 10. Year II; Semester II Summer Program courses .....	15
Table 11. Year III; Semester II Summer Program courses .....	15
Table 12. Year I; Semester I Extension Program courses .....	15
Table 13. Year I; Semester II Extension Program courses .....	16
Table 14. Year II; Semester I Extension Program courses .....	16
Table 15. Year II; Semester II Summer Program courses .....	16

## **1. BACKGROUND AND RATIONALE**

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, job creation and poverty reduction, as well as increased food security and enhanced human nutrition. 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 offtake (market supply) and competitiveness.

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. To implement the development plans effectively, the need to have more numbers of qualified animal science professionals working in different public and private sectors is mandatory. Currently, the number of animal science students graduated at MSc level from different Universities in Ethiopia is the lowest compared with other graduates from other disciplines in the area of agriculture. During the need assessment study it was noticed that the available manpower in this area of qualification in different government organizations is very low. It is paradoxical a country with the largest livestock population in the world has got very few number of highly qualified manpower in the area. The Department of Animal Science of Debre Berhan University has proposed to open MSc degree program in Animal Production to help the efforts being made by the Government to improve the sector by increasing the number of qualified manpower.

## **2. 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 86% 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 63% of them reflected their need to get trained manpower in the area of Animal Production. Generally, the study showed that there was strong interest among our potential stakeholders towards opening the postgraduate program.

### **3. OPPORTUNITIES**

#### **3.1. Staff qualification**

The Department has 7 Assistant Professor (1 PhD in Tropical Animal Production, 1 PhD in Tropical Animal Production and Health, 1 PhD in Animal Nutrition and Dairy Science, 1 DVM in Tropical Animal Production and Health, and 1 DVM in Epidemiology and 1 MSc in Animal Breeding & Genetics to be on duty for 2018/2019 academic year. There are also 5 PhD students on the study leave. Moreover, the Department has taught undergraduate students for about 10 years and has ample experiences to open and run the graduate programs in animal production and other specializations.

#### **3.2. 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. There is already an ongoing relationship between the College of Agriculture and the Research Center which will be strengthened when the program is opened.

### 3.3. Location advantage

Debre Berhan University is found in the central highlands of Ethiopia where livestock production particularly dairy, beef and sheep productions are more important components of farm activities. Feed is the most important constraint of the sector due to competition from crop production. It has been a challenge for researchers to solve the problem in the past. On the other hand there are large numbers of smallholder and commercial livestock farms and related businesses such as dairy farm, milk collection and processing centers, feedlots, abattoirs, feed processing units, poultry farms, leather factories, local and international research institutes, etc. within few kilometers radius. These are good opportunities to open the program and create linkage between the program and the sectors. It is also a good opportunity for the staff and graduate students to engage in different researches and easy to get guest lecturers if needed.

## 4. PROGRAM OBJECTIVES

The Master of Animal Science aims to promote advanced critical reflection on professional practice in the animal industries, preparing graduates for leadership positions. The course meets the educational needs of professionals working towards the advancement of animal industries; promotes the acquisition of advanced analytical, problem solving skills and. Generally, the objective of the Master's program in Animal Production is to produce candidates who:

- Are capable of designing strategies for the improvement and use of farm animals considering animal welfare and environmental sustainability.
- Hold solid theoretical knowledge and methodological skills related to animal production, management, welfare and health, and sustainability of livestock systems.
- Are capable of analyzing problems and of designing solution models relevant to the sector, public, research and education, in a national as well as international context.
- Possess the academic qualifications required to perform research, development, and disseminate knowledge at various levels based on a broad knowledge of the animal sector and its importance to the national and international society.

## **5. 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.

## **6. GRADUATE PROFILE**

Students graduated from the program will acquire the knowledge, skills and competencies, and work as educators, researchers, consultants, producers in various governmental and non-governmental institutions serving the livestock sectors at national, regional and international level. Generally, students following the Program are expected to acquire the knowledge, skills and competencies listed below.

### ***Knowledge***

- Demonstrate insight into the biological and management determinants of and constraints to animal production and performance in animal husbandry systems.
- Demonstrate knowledge on the impact of animal husbandry systems on environmental sustainability in a national and international context.
- Demonstrate knowledge on the socioeconomic importance and impact of the animal sector and principles for regulation of the sector.
- Account for understanding of the interaction of animal husbandry systems with the surrounding environment and of factors influencing sustainability of the animal sector in a national and international context.
- Critically reflect on scientific methods, including animal experimentation techniques, used within the subject areas of the program.
- Critically reflect on optimal management strategies in animal units for sustenance of animal health, welfare and performance as well as socio-economic and environmental sustainability.

### ***Skills***

- Handle complex issues in domestic animal science, interpreting information in a systematic and competent way to make informed judgments.
- Apply animal performance/production theory, e.g. for monitoring, analysis and planning of actual animal units across different animal species.
- Apply biological models and animal experimental techniques to quantify complex life processes underlying animal performance.
- Summarize and explain the management basis for optimizing animal husbandry/ production units from an animal welfare, economic and environmental perspective.
- Use relevant scientific principles to develop new solutions for optimization and improvement of performance, health and welfare status of animals, and the quality of their physical/technical environment.
- Participate in informed judgment based policy making to regulate the use of animals and their interaction with environment and society in a national and international context.



- Communicate domestic animal science clearly and effectively to specialist and non-specialist audiences, at a variety of levels, using modern and appropriate information and communication tools in the work process.

### ***Competencies***

- Capacity for independent thought, creativity and rigour in the application of knowledge and skills in work situations or in research.
- Participate in public discussions of the impact of animals and animal production on society and environment, both from an international and a national perspective.
- Manage complex and unpredictable work and development scenarios within the professional scope of the program.
- Work independently and effectively on an individual basis, as well as in project teams and interdisciplinary environments, cooperate with relevant partners, discuss solutions and reach consensus.
- Reformulate existing theories, principles and research findings to independently generate new hypotheses and theories.
- Use lifelong learning as a principle to independently evaluate and structure learning processes and assume responsibility for continuous professional development.

## **7. MODE OF DELIVERY AND TEACHING METHODS**

The courses will be delivered on semester based. The following different teaching methods will be implemented depending on the course type.

- 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

## 8. ASSESSMENT AND EVALUATION METHODS

Students will be assessed and evaluated continuously using practical work, individual assignments, tests, reports, seminars, 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.

## 9. GRADING SYSTEM

The following letter grading system will be employed. The grading systems for all courses are given below.

Table 1. Grading system

Marks	Grade	Grade Points
[90, 100)	A <sup>+</sup>	4.0
[85, 90)	A	4.0
[80, 85)	A <sup>-</sup>	3.75
[75, 80)	B <sup>+</sup>	3.50
[70, 75)	B	3.0
[65, 70)	B <sup>-</sup>	2.75
[60, 65)	C <sup>+</sup>	2.5
[50, 60)	C	2.0
< 50	F	0

### For Thesis

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.

## **10. DURATION OF STUDY**

Students in the regular program must complete the program no more than 2 years following commencement. The first year is allocated for course works and proposal writing and presentation, while the second year for conducting and defending the Research Thesis. 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. Moreover, the duration required for extension and summer programs is 3 years. In exceptional circumstance, the Department Council may waive the deadline mentioned above,

## **11. ADMISSION REQUIREMENTS**

To be admitted to a Master of Science Degree Program in Animal Production at Debre Berhan University, the applicant must have

- Completed requirements for a bachelor's degree in animal sciences, animal and range sciences, animal production and rangeland management, animal production and technology at an accredited College or University in Ethiopia or elsewhere.
- Maintained a minimum undergraduate cumulative grade point average of 2.0 (on a scale in which 4.0 equals "A");
- Must passed the entrance exam prepared by the Department;
- Deliver all administrative documentation requested
- Students from other fields of study if admitted may be required to take some prerequisite courses from under graduate program. The prerequisite courses will be worked out by the Department Graduate Council and approved by the Council of Graduate Studies.
- 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.
- The points (in percentage) allotted to each admission criterion are depicted below if passed the entrance exam.

Table 2. selection criteria

No.	Criteria	%
1	CGPA	45
2	Entrance examination	45
3	Service year and work experience to the intended field of specialization	10
4	Female applicants	5
	<b>Total</b>	<b>100%</b>

**Note:** female applicants will be given priority if they get the same points as male applicants

***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 at least the following courses:

- Animal production courses to be identified by DC
- Applied Animal breeding
- Biometry (Experimental Design and Statistical Data Analysis)
- Principle of Animal nutrition
- Animal anatomy and physiology

## **12. TIME OF APPLICATION, ENTRANCE EXAMINATION AND REGISTRATION**

In each academic year, the time of application and entrance examination will be set by the registrar office of 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 the every academic year.

## **13 GRADUATION REQUIREMENTS**

The MSc degree award is given to candidates who have satisfied the following general SGS graduation requirements.

- The students must score a minimum CGPA of 3.00 with only one 'C' but no 'F' grades and successfully defend and submit the Research Thesis.
- Comply with the minimum 31 credit hours of course works and 6 credit hours of research works.
- Development and oral defense of a research project carried out as a thesis.
- Defended the thesis successfully in an open oral exam and satisfied the general SGS graduation requirements.

## **14. 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.

## 15. DEGREE NOMENCLATURE

**English:** The Degree of Master of Science in Animal Production

**Amharic:** የማስተርስ ሳይንስ ዲግሪ በእንስሳት እርባታ

## 16. TOTAL COURSES

Table 3. Total course lists

Course Code	Course Title	Cr.Hr	Course ECTS	Contact Hour		
				Lecture	Field demonstration	Lab
ANPR 511	Advanced Animal Physiology	2	3.5	1	1	0
ANPR 521	Advanced Animal Nutrition	3	5	2	0	1
ANPR 531	Applied Animal Breeding	3	5	2	1	0
ANPR 541	Biostatistics for Animal Science	3	5	2	1	0
ANPR 551	Feed Resource Management	2	3.5	1	1	0
ANPR 561	Livestock value chain and marketing (E)	2	3.5	2	0	0
ANPR 571	Animal Health (E)	2	3.5	1	1	0
ANPR 512	Milk Production and Processing	3	5	2	0	1
ANPR 522	Meat Production and Processing	3	5	2	1	0
ANPR 532	Animal Growth and Development	2	3.5	1	0	0
ANPR 542	Advanced Poultry Production	3	5	2	1	0
ANPR 552	Animal Reproduction and Biotechnology	2	3.5	1	1	0
ANPR 562	Research methods and scientific writing	1	2.5	1	0	0
ANPR 563	Recent Topics in Animal Production	1	2.5	0	1	0
ANPR 611	Graduate Seminar	1	2.5	0	0	0
ANPR 621	Research Thesis	6		0	0	0

\*One Field demonstration is equivalent to 1 hour and one laboratory work equivalent to 3 hours.  
Courses are delivered on semester basis

## 17. COURSE LIST FOR REGULAR PROGRAM

**Table 4. Year I; Semester I Regular Program course**

Course code	Course title	Credit hours
ANPR 511	Advanced Animal Physiology	2
ANPR 521	Advanced Animal Nutrition	3
ANPR 531	Applied Animal Breeding	3
ANPR 541	Biostatistics for Animal Science	3
ANPR 551	Feed Resource Management	2
ANPR 561	Livestock value chain and marketing (E)	2
ANPR 571	Animal Health (E)	2
		15/17

(E) = Elective course: Students are required to take at least one elective course in semester I

**Table 5. Year I; Semester II Regular Program course**

Course code	Course title	Credit hours
ANPR 512	Milk Production and Processing	3
ANPR 522	Meat Production and Processing	3
ANPR 532	Animal Growth and Development	2
ANPR 542	Advanced Poultry Production	3
ANPR 552	Animal Reproduction and Biotechnology	2
ANPR 562	Research methods and scientific writing	1
ANPR 563	Recent Topics in Animal Production	1
		15

**Table 6. Year II; Semester I Regular Program course**

Course code	Course title	Credit hours
ANPR 611	Graduate Seminar	1
ANPR 621	Research Thesis	6
		7

## 18. COURSE LIST FOR SUMMER PROGRAM

**Table 7. Year I; Semester I Summer Program courses**

Course code	Course title	Credit hours
ANPR 511	Advanced Animal Physiology	2
ANPR 521	Advanced Animal Nutrition	3
ANPR 531	Applied Animal Breeding	3
		8

**Table 8. Year I; Semester II Summer Program courses**

Course code	Course title	Credit hours
ANPR 541	Biostatistics for Animal Science	3
ANPR 551	Feed Resource Management	2
ANPR 561	Livestock value chain and marketing (E)	2
ANPR 571	Animal Health (E)	2
		7/9

(E) = Elective course: Students are required to take at least one elective course in semester I

**Table 9. Year II; Semester I Summer Program courses**

Course code	Course title	Credit hours
ANPR 512	Milk Production and Processing	3
ANPR 522	Meat Production and Processing	3
ANPR 532	Animal Growth and Development	2
		8

**Table 10. Year II; Semester II Summer Program courses**

Course code	Course title	Credit hours
ANPR 542	Advanced Poultry Production	3
ANPR 552	Animal Reproduction and Biotechnology	2
ANPR 562	Research methods and scientific writing	1
ANPR 563	Recent Topics in Animal Production	1
		7

**Table 11. Year III; Semester II Summer Program courses**

Course code	Course title	Credit hours
ANPR 611	Graduate Seminar	1
ANPR 621	Research Thesis	6
		7

## 19. COURSE LIST FOR EXTENSION PROGRAM

**Table 12. Year I; Semester I Extension Program courses**

Course code	Course title	Credit hours
ANPR 511	Advanced Animal Physiology	2
ANPR 521	Advanced Animal Nutrition	3
ANPR 531	Applied Animal Breeding	3
ANPR 541	Biostatistics for Animal Science	3
		11



**Table 13. Year I; Semester II Extension Program courses**

Course code	Course title	Credit hours
ANPR 551	Feed Resource Management	2
ANPR 561	Livestock value chain and marketing (E)	2
ANPR 571	Animal Health (E)	2
ANPR 512	Milk Production and Processing	3
ANPR 522	Meat Production and Processing	3
		10/12

(E) = Elective course: Students are required to take at least one elective course in semester I

**Table 14. Year II; Semester I Extension Program courses**

Course code	Course title	Credit hours
ANPR 532	Animal Growth and Development	2
ANPR 542	Advanced Poultry Production	3
ANPR 552	Animal Reproduction and Biotechnology	2
ANPR 562	Research methods and scientific writing	1
ANPR 563	Recent Topics in Animal Production	1
		9

**Table 15. Year II; Semester II Extension Program courses**

Course code	Course title	Credit hours
ANPR 611	Graduate Seminar	1
ANPR 621	Research Thesis	6
		7

## 20. COURSE DESCRIPTIONS AND OUTLINES

<b>Course title:</b>	Advanced Animal Physiology
<b>Course code:</b>	ANPR 511
<b>Credit hour:</b>	2 (1+1)
Physiology of animals; structural and functional adaptations seen in farm animals, to a range of challenges. Coordination of responses to an animal's internal and external environment by nerves and hormones, focusing on the stress response and reproduction.	
<b>Learning Outcomes</b>	
Upon successful completion of this subject, students should be able to:	
<ul style="list-style-type: none"> <li>be able to identify important anatomical and physiological features of the various major organ systems</li> </ul>	

- Use their knowledge about organs, organ structure and different cell types to explain and describe the specialized functions and regulations of the major organs and organ systems in animals
- explain physical and behavioral animal adaptations
- provide examples of animal adaptations
- review the major endocrine glands and the function of their hormonal products especially in regulation of the stress response and reproduction
- describe the structure and function of neurones and muscle cells and explain how they are adapted for extraordinary function;

**Course outline**

1. the physiology of farm animals
2. circulatory system
3. respiratory system
4. urinary system
5. nervous system
6. what is adaptation
7. Physiological Adaptation of Animals to Hot Environment
8. structural and functional adaptations in farm animals,
9. Homeostasis, physiological, biological and genetic adaptations
10. Environmental stress affecting farm animals productivity and reproduction

<b>Course title:</b>	<b>Advanced Animal Nutrition</b>
<b>Course code:</b>	<b>ANPR 521</b>
<b>Credit hour:</b>	<b>3 (2+1)</b>
<p>Concept of food chain. Nutritional quality of feed stuff. Refractory and inhibitory substances in livestock feed. Environment and forage quality. Anatomy, function and microbes of rumen and lower gut. Kinetics of digestion and metabolism. Intermediary metabolism. Regulation of nutrient utilization for various animal products. Nutrient specification and least cost ration for different classes of livestock. Voluntary intake and its regulation. Unconventional feeds. Biotechnology for enhancement of nutritive value and utilization of nutrients. Technology of complete feed production and feed conservation. Feed crises mitigation, animal performance and forage supply</p>	
<b>Learning Outcomes</b>	
<p>Upon successful completion of this subject, students should:</p>	

- be able to describe how carbohydrates, lipids and proteins are categorized
- be able to describe in detail the digestion and absorption of dietary carbohydrates, lipids and proteins in monogastric and ruminant animals
- be able to describe how a feedstuff could be analyzed in terms of its dry matter, organic matter, lipid, crude protein and fibre contents
- be able to demonstrate the use of feeding standards to calculate the nutrient requirements of various classes of animals
- be able to formulate rations to meet the nutrient requirements of various classes of ruminants
- be able to demonstrate the practical application of science to the feeding of ruminants and a species of your choice

### **Course outline**

#### 1. Introduction

##### 1.1. Definitions of terminologies

##### 1.2. Anatomy of the digestive systems of mono-gastric animals

##### 1.3. Feed digestion and absorption in mono-gastric animals

##### 1.4. Types of feeds for mono-gastric animals

##### 1.5. Digestion and metabolism of nutrients in mono-gastric animals

##### 1.6. Anatomy of the digestive systems of ruminant animals

##### 1.7. Function of ruminant gastro intestinal tract

##### 1.8. Microbes in the gut and their function

##### 1.9. Rumen fermentation of carbohydrates

##### 1.10. Rumen fermentation of protein

##### 1.11. Rumen fermentation of lipids

#### 2. Voluntary feed intake and its regulation

#### 3. Kinetics of rumen function

##### 3.1. Methanogenesis

##### 3.2. Effects and control

#### 4. Function of feeds and feeding standards

##### 4.1. Measurement of energy value and energy requirement

##### 4.2. Role of protein quality and requirements

##### 4.3. Role of vitamins and requirements

##### 4.4. Role of mineral and requirements

##### 4.5. Role of enzymes

- 4.6. Role of feed additives
5. Conventional and un conventional Feed resources
6. Feed conservation methods
7. Nutritional quality of feed staff.
8. Biotechnology for enhancement of nutritive value and utilization of nutrients
9. Nutritional disorders, refractory and inhibitory substances in livestock feed
10. Ration formulation for different classes of animals
11. Least cost ration for different classes of livestock.
12. Environment and forage quality.
13. Feed crises mitigation

**References:**

1. McDonald, et.al.1995. Animal Nutrition
2. Cheeke, P. R. 1999. Applied Animal Nutrition: feeds and feeding
3. Pond, W.G. D.C.1995. Basic Animal Nutrition and Feeding
4. Tisch, D. 2005. Animal Feeds, Feeding and Nutrition, and Ration Evaluation
5. Kundu, S.S, Singh, S., Mahanta, S.K. and Pailah, G.H.2005. Feeding Farm Animals. Satish Serial Publishing House

<b>Course title:</b>	<b>Applied Animal Breeding</b>
<b>Course code:</b>	<b>ANPR 531</b>
<b>Credit hour:</b>	<b>3 (2+1)</b>
Application of genetic principles to animal breeding. Basic concepts of population genetics as related to theoretical animal breeding, including heritability, genetic correlations, reproductive efficiency in farm animals. Selection methods and rate of genetic improvement. In-breeding, line-breeding and cross-breeding. Critical examination of current and potential selection programs and crossbreeding systems	
<b>Learning Outcomes</b>	
Upon successful completion of this subject, students should:	
<ul style="list-style-type: none"> <li>• be able to describe how the knowledge of animal breeding is important in improving productivity of domestic animals</li> <li>• be able to design and use effective breeding strategies for different classes of farm animals</li> <li>• Be able to give recommendation on different policies developed by governmental or non-governmental institutes in the area of livestock</li> <li>• Be able to design and use conservation techniques for conserving our animal genetic resources</li> </ul>	
<b>Course outline</b>	

1. Principles of selection;
2. Genetic effect of selection;
3. Basis for selection.
4. Methods of selection,
5. Response to selection and factors affecting it.
6. Systems of mating;
7. Systems of breeding and selection for the genetic improvement of various species of livestock.
8. Special problems of implementing genetic improvement of livestock programs in the tropics (with particular reference to Ethiopia);
9. Open nucleus breeding schemes.

<b>Course title:</b>	<b>Biostatistics for Animal Science</b>
<b>Course code:</b>	<b>ANPR 541</b>
<b>Credit hour:</b>	<b>3 (2+1)</b>

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)

##### 2.4 Tukey Test

#### **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:**

1. Morris, T.R. 2002. Experimental Design and Analysis in Animal Sciences
2. Kaps, M. 2004. Biostatistics for Animal Science
3. Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Research. 2<sup>nd</sup> ed. John Willey and Sons. Inc. New York
4. Hoshand, A.R. 2004. Experimental Research Design and Analysis: A Practical Approach for

Agriculture and Natural Science. CRC Press

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

<b>Course title:</b>	<b>Feed Resource Management</b>
<b>Course code:</b>	<b>ANPR 551</b>
<b>Credit hour:</b>	<b>2 (1+1)</b>
<p>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 utilisation; 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: fertilisation; over-sowing, stocking rates, herd structures, communal and commercial grazing strategies; Principles of grassland and range management. Economics of pasture and range management</p>	
<p><b>Learning Outcomes</b></p> <p>Upon successful completion of this subject, students should</p> <ul style="list-style-type: none"><li>• be able to describe how feed is affected the performance of farm animals</li><li>• be able to solve the existing animal feed problems by introducing alternative forage development strategies</li><li>• be able to formulate feed for different classes of farm animals based on available feed ingredients</li><li>• be able to introduce different grazing land management systems for different production systems</li></ul>	
<p><b>Course outline</b></p> <ol style="list-style-type: none"><li>1. Feed resource in Ethiopia<ol style="list-style-type: none"><li>1.1. grazing and browsing</li><li>1.2. vegetation</li><li>1.3. crop residues</li><li>1.4. industrial byproducts</li><li>1.5. Cultivated Pasture and Forage-Crop Species</li></ol></li><li>2. Strategy for feed development</li><li>3. Feed development strategies and constraints</li><li>4. Grazing land management</li><li>5. Principles and economics of pasture and range management</li></ol>	

<b>Course title:</b>	<b>Livestock value chain and marketing (E)</b>
<b>Course code:</b>	<b>ANPR 561</b>
<b>Credit hour:</b>	<b>2 (2+0)</b>
<p>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</p>	
<p><b>Learning Outcomes</b></p> <p>Upon successful completion of this subject, students should</p> <ul style="list-style-type: none"> <li>• Be able to design value chain development projects</li> <li>• Be able to understand the foundation of market development and value chain promotion</li> <li>• Be able to understand the different roles that relevant stakeholders play in value chain.</li> <li>• Be able to identify the advantages and disadvantages of a value chain approach</li> <li>• Be able to design efficient marketing systems of livestock</li> </ul>	
<p><b>Course outline</b></p> <ol style="list-style-type: none"> <li>1. Definition of livestock value chain and marketing</li> <li>2. economics importance of livestock to the national economic</li> <li>3. Allocation of factors of production and profit maximization,</li> <li>4. farm planning and budgeting</li> <li>5. Farm accounts and accounting analysis.</li> <li>6. Demand for and supply of livestock and livestock products.</li> <li>7. Marketing system; channels costs and margins problems and obstacles in livestock marketing livestock resource development in Ethiopia</li> </ol>	

<b>Course title:</b>	<b>Animal Health (E)</b>
<b>Course code:</b>	<b>ANPR 571</b>
<b>Credit hour:</b>	<b>2 (1+1)</b>
<p>General epidemiology chains of disease, the aetiology, source and route of infection, ways and means of disease transmission and ways of exit and impact on the host. Aetiology, epidemiology, symptoms, diagnosis, prevention and control of external and internal parasite of farm animals with a special focus on</p>	



ticks, mites, insects, helminthes and protozoa of tropical importance. Infectious diseases of farm animals caused by bacteria, virus and rickettsia, zoonotic diseases of public health importance. Non-infectious disease prevention and control. Health management programs in extensive and intensive farming systems; biotechnological advances in diagnosis and prevention of livestock diseases

### **Learning Outcomes**

Upon successful completion of this subject, students should

- Be able to recognize and explain the differences between normal and unhealthy animals within an animal enterprise;
- Be able to discuss important examples of endemic and exotic infectious animal diseases and the causative agents, including prions, viruses, bacteria, fungi and parasites, and zoonotic agents when important;
- Be able to discuss examples of non-infectious animal diseases, including metabolic and genetic conditions, that could be significant with regard to herd or collection health;
- Be able to describe and discuss the impacts of stress on animal health, and how to recognize and remediate stressed animals;
- Be able to communicate effective animal health strategies to a range of next user and end users.

### **Course Content**

#### 1. INTRODUCTION

1.1. General epidemiological concepts and definitions

1.2. The uses of epidemiology

1.3. Types of epidemiological investigation

1.4. Components of epidemiology

#### 2. DISEASE OCCURRENCES

2.1. Disease manifestation in a population

2.2. Determinants of disease occurrence

2.3. Disease transmission

2.3.1. Type of transmission

2.3.2. Mode of transmission

2.4. Sources of infectious agent

2.4.1. Primary and secondary sources

2.4.2. Specific sources of disease causing agents

2.5. Routes of infectious agent entry

2.5.1. Oral route

2.5.2. Respiratory route

2.5.3. Percutaneous route
2.6. Maintenance strategies of disease causing agents
2.7. Disease events
2.7.1 Infectious process
2.7.2. Epizootic process
3. QUANTIFICATION OF DISEASE EVENTS IN POPULATIONS
3.1. Proportions, Ratios and Rates
3.2. Surveillance
4. LIVESTOCK DISEASES
4.1. Infectious diseases
4.2. Bacterial diseases
4.3. Viral diseases
4.4. Fungal diseases
4.5. Parasitic diseases

<b>Course title:</b>	<b>Milk Production and Processing</b>
<b>Course code:</b>	<b>ANPR 512</b>
<b>Credit hour:</b>	<b>3 (2+1)</b>
<p>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.</p>	
<p><b>Learning Outcomes</b></p> <p>Upon successful completion of this subject, students should:</p> <ul style="list-style-type: none"> <li>• Be able to describe how milk is produced and how it is affected</li> <li>• Be able to deliver good management techniques for milking animals at different stages</li> <li>• Be able to apply the reproductive principles to control reproductive wastage in animals;</li> <li>• Be able to evaluate the reproductive potential and evaluate factors that limit reproduction and</li> </ul>	

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. Methylene blue reduction test

10.11. Sediment or visible dirt test

10.12. Moisture content of butter

10.13. Salt content of butter

<b>Course title:</b>	<b>Meat Production and Processing</b>
<b>Course code:</b>	<b>ANPR 522</b>
<b>Credit hour:</b>	<b>3 (2+1)</b>
<p>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</p>	
<p><b>Learning Outcomes</b></p> <p>Upon successful completion of this subject, students should:</p> <ul style="list-style-type: none"><li>• Be able to describe the different meat production systems found in the country</li><li>• Be able to explain how meat is produced and how it is affected by different management systems</li><li>• Be able to recommend different management techniques for small scale meat production and commercial feedlots</li><li>• Be able to identify between the good and bad quality meat and describe the local and international marketing systems of meat</li></ul>	
<b>Course Content</b>	

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:**

1. 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
2. John St. and Clotey 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.
3. Guidelines for slaughtering, meat cutting and further processing. FAO animal production and health paper 91. Food and
1. Agriculture Organization of the United Nations, Via delle Terme di Caracalla, 00 100 Rome, Italy.

<b>Course title:</b>	<b>Animal Growth and Development</b>
<b>Course code:</b>	<b>ANPR 532</b>
<b>Credit hour:</b>	<b>2 (2+0)</b>

This subject will examine the processes of growth and development from conception through to maturity in farm animals. Development of skeletal muscle, bone, and adipose tissue: organ growth discussed. Recent literature as well as classical concepts of animal growth discussed along with the genetic, hormonal, and nutritional factors that affect growth. Factors that control growth will be examined from genetic, epigenetic, nutritional, and hormonal perspectives, including reference to growth disorders and growth manipulation

### Learning Outcomes

Upon successful completion of this subject, students should:

- be able to describe foetal development and the factors that can have a lifelong influence on the newborn animal;
- be able to describe the process of differentiation and the growth of bone, muscle and adipose tissue;
- be able to explain the concept of nutrient partitioning and the control of body composition; and
- be able to discuss the ways in which animal growth and composition are manipulated in the interests of livestock production or animal health

### Course outline

1. Embryogenesis and tissue development
2. Epigenetics of growth and development
3. Perinatal growth and development
4. Postnatal growth and development
5. Growth of specialized tissue structures
6. Growth and development of farm animals

<b>Course title:</b>	<b>Advanced Poultry Production</b>
<b>Course code:</b>	<b>ANPR 542</b>
<b>Credit hour:</b>	<b>3 (2+1)</b>
<p>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</p>	

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 and 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.

<b>Course title:</b>	<b>Animal Reproduction and Biotechnology</b>
<b>Course code:</b>	<b>ANPR 552</b>
<b>Credit hour:</b>	<b>2 (1+1)</b>
<p>Reproductive anatomy, physiology, endocrinology and behavior in selected farm animal. Physiological processes of reproduction in farm animals, gonad function, endocrine relationships, fertility, and factors affecting reproduction efficiency. Emphasis on principles of artificial insemination in the laboratory; Animal molecular biology, recombinant DNA technology, production of transgenic animals, reproductive biotechnology, biotechnology in animal breeding and ethics.</p>	
<p><b>Learning Outcomes</b></p> <p>Upon successful completion of this subject, students should:</p> <ul style="list-style-type: none"> <li>• Be able to describe reproductive anatomy and related function in major farm animal species;</li> <li>• Be able to discuss the processes of gametogenesis, fertilization, maternal recognition of pregnancy, foetal development, placentation, parturition, puerperium and lactation;</li> <li>• Be able to apply the reproductive principles to control reproductive potential in animals;</li> <li>• Be able to evaluate the reproductive potential and evaluate factors that limit reproduction in males and females and develop management strategies to improve fertility;</li> <li>• Be able to discuss and explain in detail artificial breeding techniques for domestic animals and explain the benefits of using such techniques;</li> <li>• Be able to describe the principles and techniques in genetic manipulation and genetic engineering.</li> <li>• Be able to describe gene transfer technologies for animals and animal cell lines, giving detailed examples of each</li> </ul>	
<p><b>Course outline</b></p> <ol style="list-style-type: none"> <li>1. Anatomy of reproduction in the male and female</li> <li>2. Endocrine control of reproduction in the male and female</li> <li>3. The events of the oestrous cycle, endocrine, physiological and behavioral</li> <li>4. The process of gamete transport and fertilization</li> <li>5. Factors affecting puberty, anoestrus and seasonality</li> </ol>	



6. Maternal recognition of pregnancy, placentation and foetal development
7. Parturition, lactation and the puerperium
8. The assessment of reproductive potential
9. The use of artificial breeding technologies to improve reproductive potential
10. Methods to decrease reproductive potential, contraception, in domestic, wild and pest species
11. Factors limiting reproductive potential and their management
12. Reproductive biology and management of selected domestic and wild species
13. Recent advances in reproductive biotechnology of farm animals

<b>Course title:</b>	<b>Research methods and scientific writing</b>
<b>Course code:</b>	<b>ANPR 562</b>
<b>Credit hour:</b>	<b>1 (1+0)</b>
<p>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.</p>	
<p><b>Learning Outcomes</b></p> <p>Upon successful completion of this subject, students should:</p> <ul style="list-style-type: none"> <li>• Be able to explain and apply techniques for scientific writing and research methodology to prepare the writing of a scientific report.</li> <li>• Be able to perform investigation using methods, explain and take position on the results as well as summarize related work</li> <li>• Be able to apply the knowledge in scientific writing and research methodology and use the knowledge to write a scientific report.</li> </ul>	
<p><b>Course outline</b></p> <ol style="list-style-type: none"> <li>1. Research Methodologies <ul style="list-style-type: none"> <li>• main focus on qualitative and quantitative methods</li> <li>• Consider alternative methods &amp; choose a suitable method</li> </ul> </li> <li>2. Scientific Writing –reporting your results <ul style="list-style-type: none"> <li>• Improving your writing and oral presentation skills</li> </ul> </li> </ol>	

- Avoiding Plagiarism
  - Opposition –giving and receiving feedback
3. Research and professional ethics

<b>Course title:</b>	<b>Recent Topics in Animal Production</b>
<b>Course code:</b>	<b>ANPR 563</b>
<b>Credit hour:</b>	<b>1 (0+1)</b>
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	
<b>Learning Outcomes</b>	
Upon successful completion of this subject, students should:	
<ul style="list-style-type: none"> <li>• Be able to synthesize and write different review papers based on recent literatures and findings in the area of animal science</li> <li>• Be able to confidently present different seminars at national and international forums.</li> <li>• be able to demonstrate verbal and written skills relevant to advanced studies</li> </ul>	

<b>Course title:</b>	<b>Graduate Seminar</b>
<b>Course code:</b>	<b>ANPR 611</b>
<b>Credit hour:</b>	<b>1 (0+1)</b>
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	
<b>Learning Outcomes</b>	
Upon successful completion of this subject, students should:	
<ul style="list-style-type: none"> <li>• Be able to confidently present different seminars at national and international forums.</li> <li>• be able to demonstrate verbal and written skills relevant to advanced studies</li> <li>• be able to demonstrate an advanced level of knowledge in the area of specialization,</li> </ul>	

<b>Course title:</b>	<b>Research Thesis</b>
<b>Course code:</b>	<b>ANPR 621</b>
<b>Credit hour:</b>	<b>6 (0+6)</b>
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.	
<p><b>Learning Outcomes</b></p> <p>Upon successful completion of this subject, students should:</p> <ul style="list-style-type: none"> <li>• be able to demonstrate knowledge and skills relevant to conducting research, especially for entry to higher degree courses;</li> <li>• be able to demonstrate an advanced level of knowledge in the area of specialization, and</li> <li>• be able to demonstrate verbal and written skills relevant to advanced studies</li> </ul>	