CURRICULUM
for
Diploma in Agriculture (Animal Science)
(Three-year program-yearly system)

Council for Technical Education and Vocational Training
Curriculum Development and Equivalence Division
Sanothimi, Bhaktapur

Development: 2002
First Revision: 2014
Second Revision: 2021
Third Revision: 2025 (2082 BS)

Contents

Introduction

Agriculture is the primary source of livelihood for most Nepalese people and remains a vital sector of the economy. It contributes approximately one-fourth of Nepal's gross domestic product (GDP) and supports the majority of the population through integrated crop and livestock farming, which is largely subsistence-based. With green vegetables, meat, milk, and milk products, as well as fish, the agricultural sector is heading towards self-sufficiency. Meanwhile, niche products such as cardamom, ginger, tea, coffee, and honey have been established as prominent commercial and export products.
The Constitution of Nepal guarantees food and nutritional security for all citizens, prioritizing the agriculture sector. Agriculture drives employment generation, import substitution, and export promotion which is fundamental to poverty reduction in the country. With globalization, Nepal's agriculture sector is adopting technology driven, mechanized, commercial and innovative approaches. The rapid advancement in information and communication technology (ICT) has enabled farmers to become more aware of new agricultural practices. Producing skilled human resources is critical to achieve these goals and address sectorial challenges.

Council for Technical Education and Vocational Training (CTEVT) has been able to produce skilled human resource in agriculture in Nepal. As the apex organization for technical and vocational human resource development, CTEVT is committed to address the emerging needs in the changing context. This requires a comprehensive curriculum that integrates both contextual and contemporary needs. In this context, CTEVT has introduced a revised curriculum for Diploma in Agriculture (Animal Science).

Curriculum Title

The title of this program is "Diploma in Agriculture (Animal Science)".

Program Aim

The program aims to prepare competent mid-level technical human resource equipped with knowledge and skills in Animal Science, agriculture and related disciplines.

Program Objectives

The curriculum has the following objectives:

- Provide animal nutrition, health, and management services for small-scale and commercial farming operations.
- Deliver extension and community development services as a front-line extension worker.
- Conduct farmers training as a local level resource to enhance productivity, animal health, land management, and technology adoption.
- Manage agribusiness and cooperative services in rural and urban areas across public and private sectors.
- Promote contemporary technology based animal husbandry practices, including breeding, commercial livestock, poultry production, aquaculture, and fisheries.
- Foster organic and sustainable husbandry technologies and systems.

- Communicate effectively and work collaboratively in multidisciplinary and multicultural work environments through recognizing and understanding global environmental, social, and ethical contexts of their works
- Enable to prepare business plan for establishing small scale production and service-related vet-enterprise firms.

Program Description

This course is based on the job required to perform by agriculture technicians at different levels of public and private sectors of agriculture and community development related works in Nepal. Therefore, this curriculum is designed to provide knowledge and skills, attitudes, believes and values focusing on Animal Science related to the occupation. The program is structured across three years: the first year focuses on foundational and basic disciplinary subject of animal science, second year emphasizes disciplinary subjects in Animal Science, particularly animal health and husbandry production and management systems; and the third-year concentrates on marketing and enterprise development. A six-month Internship Program in the third year provides workplace-based learning, enabling learners to apply their skills in world of work settings.

The curriculum is grounded in a "must know, must do" approach, with subject content detailed at a micro level to ensure comprehensive learning. This structure guides implementers to produce competent, highly employable mid-level technical workforce in agriculture, contributing to Nepal's food security and economic development

Rationale for Revision

The Diploma in Agriculture (Animal Science) curriculum, first developed in 2002, underwent its third revision in 2025 following its second revision in 2021. This revision was driven by the following reasons

- The curriculum has completed a three-year academic cycle since its 2021 revision, and technical schools and implementing agencies have requested updates based on their teaching and learning experiences.
- Technical schools and industry have requested shifting to a yearly system, mentioning insufficient time in the semester system for practical and project-based learning to cover full plant and animal production cycles
- Restructuring of subjects by year is necessary to enhance coherence and alignment with program objectives.
- Rebalancing the weightage of theory and practical components is required to emphasize practical and hands-on learning experience.
- Emerging and green technologies in agriculture should be incorporated to ensure relevance and sustainability.

Additionally, the demand for agricultural technicians is projected to grow faster than the average for all occupations, driven by national and international workforce requirement for sustainable livestock farming, food security and vet-enterprise development. To meet these demands, the curriculum has been updated to equip learners with current knowledge and skills, ensuring graduates are competent and competitive in the agricultural sector.

Program Duration

The Diploma in Agriculture (Animal Science) is a three-year program based on yearly system. Each academic year comprises 35 academic weeks excluding evaluation period.

Target Location

The target location is all over Nepal

Group Size

The group size is a maximum of 40 in a batch.

Target Group

The program is designed for eligible candidates interested in pursuing a career in agriculture, particularly in the field of animal science

Entry Qualifications

- Completion of SLC or SEE or equivalent with a minimum C grade in any two subjects and a D+ grade in one subject among Mathematics, Science, and English
- Completion of Pre-diploma in Agriculture (Plant, Animal Science) or equivalent with a minimum of 68.33%.
- Passing the entrance examination administered by CTEVT.

  Or

- According to the admission guidelines of CTEVT's Office of the Controller of Examinations.

Medium of Instruction

The medium of instruction is English and/or Nepali.

Pattern of Attendance

A minimum of 90% attendance in each subject is required to be eligible for the final examination.

Instructor-Learners Ratio

The instructor-to-learners ratio is as follows:

- 1:40 for theory classes.
- 1:10 for practical classes.

Qualifications of Instructional Staff

- The program coordinator must hold a master's degree in agriculture, animal science or a related field.
- Instructors and demonstrators for disciplinary subjects must hold a bachelor's degree in agriculture, animal science or a related field.
- Teachers for foundational subjects (core and academic courses) must hold a master's degree in a related field.

Instructional Media and Materials

The program utilizes the following instructional media and materials:

- ***Printed materials:*** Assignment sheets, case studies, handouts, performance checklists, textbooks etc.
- ***Visual aids:*** Displays, models, photographs, flip charts, poster, writing board etc.
- ***Projected media****:* Slides, digital presentations, multimedia projectors etc.
- ***Audio-visual resources:*** Videos, áudio recordings, interactive multimedia etc.
- ***Computer-based resources:*** Computer-based training programs and interactive digital tools.
- **Web-Based resources:** Online learning platforms and educational websites.
- **Social media platforms:** Education focused platforms for collaborative learning and resource sharing.

Teaching Learning Methodologies

The program employs a combination of teaching and learning methodologies, including:

- Theory: Lectures, Group discussions, assignments and group projects.
- Practical: Demonstrations, observations, guided practice and independent-practice.
- Project/problem-based learning (PBL): Project work, case studies, field investigations, collaborative problem-solving, simulation exercises, and real-world task implementation
- Work Based Learning (WBL):

  Additional methods include illustrated talk, simulations, role plays, field visits, laboratory work, report writing, power point presentation, term paper presentations, case studies, and tutoring.

Examinations and Marking Scheme

a. Internal Assessment

- A transparent and fair evaluation system for both theory and practical components of each subject.
- Internal assessments are conducted at regular intervals, with feedback provided to learners.
- Weightage of theory and practical marks are specified in curriculum structure.

- Continuous assessment formats will be developed and applied by the evaluators for evaluating learner's performance in the subjects related to the practical task.
- Continuous Assessment Marks (CAM) are specified for the practical component of each disciplinary subject, based on its list of tasks.

b. Final Examination

- The marking scheme for final written exams is developed to guide test item development for each subject.
- Learners must pass both theory and practical components of all subjects to receive certification. Those who do not pass may retake the examination as per CTEVT policy.
- Completion of internal assessment requirements is mandatory to be eligible for the final examination.

c. Requirement for Final Practical Examination

- Professional of relevant subject instructor must evaluate final practical examinations.
- Each evaluator assesses no more than 20 learners per session.
- Practical examinations are conducted in relevant field or laboratory settings, with at least one internal evaluator from concerned institute and an external evaluator from other organization or nominated by CTEVT.
- Re-examination provisions follow CTEVT policy.

d. Final Practical Assessment Criteria:

- Institutional practical attendance: 10%
- Logbook or practical record updates: 10%
- Spot performance (assigned task/practicum performance/identification/arrangement preparation/measurement): 60%
- Viva voce: 20%
- Based on above mentioned criteria institute must developed format and assess accordingly.

e. Pass Marks:

- The learners must secure minimum 40% marks in theory and 50% marks in practical. Moreover, the learners must secure minimum pass marks in the internal assessment and in the yearly final examination of each subject to pass the subject.

Provision for Re-examination

- A provision for re-examination exists for the learners who fail a subject.
- Learners must pass all subjects across all years within six years from their enrollment date.
- Final-year learners are eligible for supplementary examinations as per CTEVT guidelines.

Grading System

The grading system is as follows:

Grading	Overall marks

- Distinction: 80% and above
- First division: 65% to below 80%
- Second division: 50 % to below 65%
- Pass division: 40 % to below 50%

Certificate Awarded

- Learners who successfully complete all required subjects across the three-year program will be awarded a degree of **"Diploma in Agriculture" (Animal Science)**

Questions Pattern

Full Marks 80

Questions type	No. of Questions	Total marks	Remarks
Long	2+1	20	Each question type contains one choice question
Short	10 + 1	50	
Very short	5+1	10	
Total	17+3	80	

Two questions are based on list of tasks in the disciplinary subject**.**

Full Marks 40

Questions type	No. of Questions	Total marks	Remarks
Long	1+1	10	Each question type contains a choice question
Short	5 + 1	25	
Very short	2+1	5	
Total	8+3	80	

One question is based on list of tasks in the disciplinary subject.

Career Path

- Graduates are eligible for positions equivalent to Non- gazetted First class/Level 5 (Technical) in the agriculture sector as recognized by the Public Service Commission of Nepal.
- Start and manage their own agri-enterprises in areas like animal husbandry and veterinary services and other related areas.
- Employed as production supervisors or farm managers in commercial farms, agribusiness companies or agro-vet firms.
- Work with NGOs/INGOs working on the rural development, food security and sustainable agriculture.
- Pursue further studies in Bachelor-level programs such as Bachelor in Animal Science/ B.Sc. Agriculture or related disciplines.

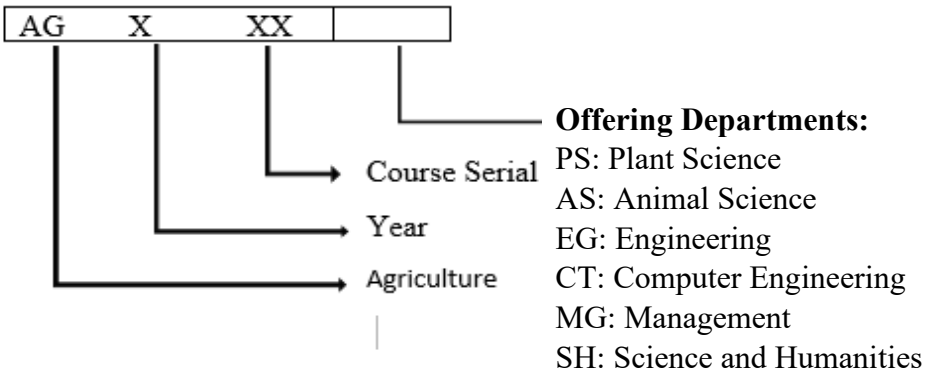
General Attitudes Required

Learners are expected to demonstrate the following attitudes to support effective learning and professional development in agriculture:

- Cooperative: Actively collaborates with peers, faculty, and industry professionals.
- Responsible: Takes accountability for academic and list of tasks.
- Hardworking: Commits to rigorous study and hands-on practice.
- Ethical: Upholds honesty and integrity in academic and professional activities.
- Adaptable: Responds effectively to challenges and changing agricultural contexts.
- Punctual: Adheres to schedules for classes, fieldwork, and internships.
- Self-disciplined: Maintains focus and meets deadlines independently.
- Respectful: Shows consideration for peers, faculty, and community stakeholders.

Course Structure

Each subject is coded with a unique number preceded and followed by certain letters as mentioned in following chart



Course Structure:

Diploma in Agriculture (Animal Science)

First Year

Subjects			Mode		Hours		Marks distribution						Total Marks	Remark
							Theory			Practical				
S.N.	Code	Title	Theory	Practical	Weekly	Credit	*Assmt Marks	Final Marks	Time Hrs.	*Assmt Marks	Final Marks	Time Hrs.		
1	AG-101-AS	Animal Nutrition -I	2	2	4	3	10	40	1.5	30	20	3	100	*Continuous assessment
2	AG-102-AS	Animal Health-I	2	2	4	3	10	40	1.5	30	20	3	100	
3	AG-103-SH	Mathematics	4	1	5	5	20	80	3	25	-	-	125	
4	AG-104-SH	Physics	4	2	6	5	20	80	3	30	20	3	150	
5	AG-105-SH	Chemistry	4	2	6	5	20	80	3	30	20	3	150	
6	AG-106-SH	Zoology	3	2	5	4	20	80	3	30	20	3	150	
7	AG-107-SH	Botany	3	2	5	4	20	80	3	30	20	3	150	
8	AG-108-AS	Introductory Animal Science	3	2	5	4	20	80	3	30	20	3	150	
		Total	**25**	**15**	**40**	**33**	**140**	**560**		**235**	**140**		**1075**	

Course Structure:
Diploma in Agriculture (Animal Science)

Second Year

Subjects			Mode		Hours		Marks distribution						Total Marks	Remark
							Theory			Practical				
S.N.	Code	Title	Theory	Practical	Weekly	Credit	*Assmt Marks	Final Marks	Time Hrs.	*Assmt Marks	Final Marks	Time Hrs.		
1	AG-201-SH	English	3	1	4	4	20	80	3	25	-	0	125	*Continuous assessment
2	AG-202-AS	Applied Animal Breeding	2	1	3	3	10	40	1.5	25	-	0	75	
3	AG-203-AS	Animal Health – II	3	1	4	4	20	80	3	25	-	0	125	
4	AG-204-AS	Animal Husbandry –I	2	2	4	3	10	40	1.5	30	20	4	100	
5	AG-205-AS	Animal Husbandry –II	3	3	6	5	20	80	3	60	40	4	200	
6	AG-206-PS	Extension and communication	2	1	3	3	10	40	1.5	25	-	-	75	
7	AG-207-AS	Animal Product Technology	2	2	4	3	10	40	1.5	30	20	3	100	
8	AG-208-AS	Animal Nutrition – II	2	2	4	3	10	40	1.5	30	20	3	100	
9	AG-209-AS	Clinical Practice -1	-	3	3	2	-	-	-	60	40	4	100	
10	AG-210-AS	Animal Husbandry Project	-	5	5	3	-	-	-	75	50		125	
		Total	**19**	**21**	**40**	**33**	**110**	**440**		**385**	**190**		**1125**	

Course Structure:
Diploma in Agriculture (Animal Science)

Third Year

Subjects			Mode		Hours		Marks distribution						Total Marks	Remark
S.N.	Code	Title	Theory	Practical	Weekly	Credit	Theory			Practical				
							*Assmt Marks	Final Marks	Time Hours	*Assmt Marks	Final Marks	Time Hours		
1	AG-301-SH	Nepali	3	-	3	3	20	80	3	-	-	-	100	*Continuous assessment
2	AG-302-AS	Animal health – III	2	3	5	4	10	40	1.5	60	40	4	150	
3	AG-303-PS	Agricultural Economics, Marketing and Cooperatives	2	2	4	3	10	40	1.5	30	20	3	100	
4	AG-304-AS	Aquaculture and Fisheries	2	1	3	3	10	40	1.5	25	-	-	75	
5	AG-305-AS	Clinical Practice-II	-	2	2	1				30	20	3	50	
6	AG-306-MG	Entrepreneurship Development	1	2	3	3	25	-		30	20	3	75	
		Total	**10**	**10**	**20**	**17**	**75**	**200**		**175**	**100**		**550**	

					Practical Final Marks			
7	AG-307-AS	Internship	Weekly Hours	5	Industry/Supervisor	Internal/Institute	External/OCE	Total
			20		200	200	100	500
Total								**1050**

First year

1. Animal Nutrition-I
2. Animal Health – I
3. Mathematics
4. Physics
5. Chemistry
6. Zoology
7. Botany
8. Introductory Animal Science

Animal Nutrition -I

Course Code: AG-101-AS

Year: I **Total: 4 hours /week**
Theory: 2 hours/week
Practical: 2 hours/week

Course description:

This course is designed to provide foundational knowledge and practical skills in animal nutrition, tailored to local and commercial practices in Nepal. This subject equips with competencies in feed industry operations, livestock management, and nutrition for real-world applications.

Course objectives:

Upon completion of this course, learners will be able to:

- Explain the principles and scope of animal nutrition and its role in livestock productivity.
- Define key nutritional terms and classify various nutrients.
- Identify and evaluate different feedstuffs for ruminants and non-ruminants.
- Conduct nutrient analysis and formulate balanced rations for different livestock species.
- Apply feed processing techniques and adhere to feed quality standards.
- Demonstrate practical skills in assessing nutrient requirements, formulating feeds, and enhancing the nutritional value of crop residues.

Course Contents

Theory **70 Hrs.**

Unit 1: Introduction to Animal Nutrition **4 Hrs.**

1.1. Definition, scope, and objectives of animal nutrition in the context of Nepal
1.2. Key nutritional terms: feed, food, diet, ration, metabolism, and other terms
1.3. Nutritional impact on livestock and poultry growth, reproduction, health and production.
1.4. Composition of plant and animal cells and their relation to nutrient roles

Unit 2: Nutrients and Their Biological Functions **12 Hrs.**

2.1. Water: roles and sources
2.2. Carbohydrates: types, roles, and sources
2.3. Lipids: types, roles, and sources
2.4. Proteins: types, roles, and sources
2.5. Vitamins and Minerals: sources, roles, deficiency symptoms, and toxicity
    2.5.1. Macro Minerals: Ca, P, K, Na, Cl, S, Mg
    2.5.2. Micro Minerals: Mn, Co, Cu, Zn, Se, I, Fe
    2.5.3. Fat-soluble and water-soluble Vitamins

Unit 3: Classification and Composition of Feedstuffs **8 Hrs.**

3.1 Classification and examples of feedstuffs
3.2 Introduction to conventional and unconventional feeds
3.3 Energy-rich feedstuffs: sources and total calories content
3.4 Protein-rich feedstuffs: sources and crude protein content

3.5 Roughages and concentrates: characteristics and classifications
3.6 Unconventional feedstuffs: example, importance and usage in Nepal
3.7 Feed additives used in context of Nepal: vitamins, minerals, enzymes, probiotics, and other supplements

Unit 4 Digestive Physiology in Ruminants and Non-Ruminants 10 Hrs.

4.1. Digestion of carbohydrates in ruminants and non-ruminants
4.2. Digestion of proteins in ruminants and non-ruminants
4.3. Digestion of lipids in ruminants and non-ruminants

Unit 5 Evaluation of Feed Quality 10 Hrs.

5.1. Nutritional content evaluation (proximate analysis): principles and applications
5.2. Methods and principle for analyzing crude protein, crude fiber, ether extract, ash, nitrogen free extract, and moisture
5.3. Determination of Total Digestible Nutrients (TDN) and Digestible Crude Protein (DCP): principles and applications
5.4. Anti-nutritional factors in feed ingredients and preventive measures

Unit 6. Species Specific Nutrient Requirements 8 Hrs.

6.1. Overview of feeding standards: cattle, buffalo, sheep, goat, swine, and poultry
6.2. Methods for calculating nutrient requirement for maintenance, growth, reproduction and lactation in ruminants and non-ruminants (including poultry)
6.3. Nutritional strategies for different stages of production: milk production, meat production, egg production, breeding and draft purpose

Unit 7: Feed Processing and Quality Standards 4 Hrs.

7.1. Principles of feed processing: grinding, mixing and pelleting
7.2. Best practices for storage and handling including common practices according to the eco-zone
7.3. Regulatory standards and quality control in Nepal

Unit 8: Enhancing Nutritional Value of Crop Residues and Balanced Ration 10 Hrs.

8.1. Crop residues: types, merits and limitations
8.2. Techniques for nutritional enrichment: urea treatment, fortification, and enzyme treatment.
8.3. Balanced rations and factors affecting nutrient requirements
8.4. Ration formulation methods: Hit and trial method and Pearson method

Unit 9: Dry Season and Strategies to Mitigate Nutritional Gaps 4 Hrs.

9.1. Characteristics of fodder and pasture grass in the dry season
9.2. Effects of dry season on livestock
9.3. Strategies to mitigate nutritional gaps
9.4. Nutrition management during extreme climatic condition and emergencies.

Practical **70 Hrs.**

S. N	List of Tasks	Hrs.	CAM
1	Prepare a catalogue of at least 10 locally available feeds.	4	2
2	Develop a nutritional chart for the production period (cow, goat and poultry)	6	5
3	3.1 Formulate a nutritional plan for different stages of cattle using locally and commercially available feedstuffs 3.2 Present on chart paper (cattle, buffalo, goat, pig and poultry)	10	6
4	Formulate a nutritional plan for different stages of buffalo using locally and commercially available feedstuffs	6	5
5	Formulate a nutritional plan for different stages of sheep/goat using locally and commercially available feedstuffs	6	5
6	Apply techniques for nutritional enrichment: Urea treatment	6	5
7	Develop strategies to mitigate nutritional deficiencies during the dry season in your locality	6	4
8	8.1 Visit a commercial or government farm and animal feed laboratory to observe feeding practices 8.2 Prepare a report in MS Word.	12	8
9	9.1Formulate feed by Hit and Trial and Pearson Methods. 9.2 Present findings in a group (cattle, buffalo, goat, pig and poultry) using MS PowerPoint	14	10
Total		**70**	**50**

Learning References

- McDonald, P., Greenhalgh, J. F. D., Edwards, R., Morgan, C. A., Sinclair, L. A., & Wilkinson, R. G. (2011). *Animal nutrition* (7th ed.). Pearson Education.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	Pr.	Total
Unit Hours	4	12	8	10	10	8	4	10	4	-	70
Marks	2	6	4	5	5	4	2	5	2	5	40

(Pr. means Practical)

Animal Health-I

Course Code: AG-102-PS

Year: I **Total: 4 hours /week**
Theory: 2 hours/week
Practical: 2 hours/week

Course Description

This course is designed to provide foundational knowledge of the gross anatomy and physiology of the skeletal, digestive, respiratory, circulatory, reproductive, urinary, nervous, and endocrine systems in various animals, with a focus on livestock and poultry relevant to Nepal.

Course Objectives

Upon completion of this course, learners will be able to:

- Describe the gross structures of different animal systems.
- Explain the physiology and functions of organs within these systems.

Course Contents

Theory **70 Hrs.**

Unit 1: Introduction to Anatomy and Physiology **2 Hrs.**

1.1 Definition of anatomy and physiology
1.2 Branches of anatomy

Unit 2: Skeletal System of Animals **15 Hrs.**

2.1 Definition of bone, cartilage, ligament and tendon
2.2 Structure and chemical composition of bone
2.3 Classification of bones based on shape and function: long, short, flat, and irregular
2.4 Brief classification of the skeletal system of cattle: appendicular and axial system
2.5 Brief classification of joints
2.6 Vertebral formula of domestic livestock (cattle, buffalo, horse, sheep, goat, pig), pets (rabbit, dog, cat) and poultry

Unit 3: Anatomy and Physiology of the Digestive System **12 Hrs.**

3.1 Digestive system of ruminants with its functions
3.2 Digestive system of non-ruminants and mono-gastric animals with their functions
3.3 Digestive system of poultry and its functions
3.4 Comparison of digestive systems in ruminants and non-ruminants

Unit 4: Anatomy and Physiology of the Reproductive System **10 Hrs.**

4.1 Male and female reproductive systems of ruminant (cattle, goat) and their functions
4.2 Male and female reproductive systems of non-ruminants (pig, dog) and their functions
4.3 Structure and function of mammary glands of cows

Unit 5: Anatomy and Physiology of the Respiratory System of Animal **6 Hrs.**

5.1 Respiratory system with their functions: Cattle and poultry
5.2 Basics of gaseous exchange in livestock (cattle, pig and poultry)

Unit 6: Anatomy and Physiology of the Circulatory System of Animal 7 Hrs.

6.1 Definition of blood and classification of different blood cells and its function

6.2 Circulatory system of cattle with their functions: Blood vessels, heart, hepatic portal system

Unit 7: Anatomy and Physiology of the Excretory System of Animal 6 Hrs.

7.1 Excretory system of Cattle and Poultry with their functions: Skin and urinary system

Unit 8: Anatomy and Physiology of the Nervous System (NS) of Animal 6 Hrs.

8.1 Classification of nervous system: Somatic NS and Autonomic NS

8.2 Organs of nervous system with their functions: Brain and Spinal Cord

Unit 9: Anatomy and Physiology of Endocrine System of Animal 6 Hrs.

9.1 Hormones secreted by different gland of endocrine system with their function: Hypothalamus, Pituitary gland, Thyroid gland, Parathyroid gland, Pancreases, Adrenal gland, Pineal gland

9.2 Difference between endocrine and exocrine system

Practical 70 Hrs.

S. N.	List of Tasks	Hrs.	CAM
1	1.1 Identify different bones and joints present in the skeletal system of cattle 1.2 Draw sketch of skeletal system of cattle in chart paper/ flip chart	8	6
2	2.1 Identify different bones and joints present in the skeletal system of pig 2.2 Draw sketch of skeletal system of pig in chart paper/ flip chart	8	6
3	3.1 Identify different bones and joints present in the skeletal system of dog 3.2 Draw sketch of skeletal system of dog in chart paper/ flip chart	8	6
4	4.1 Dissect and study on visceral organs of goat 4.2 Prepare a report of the dissection in Ms-Word	8	6
5	5.1 Dissect and study on visceral organs of poultry 5.2 Prepare a report of the dissection in Ms-Word	8	6
6	Study entire body systems of dog by using 3-D digital model	5	2
7	Demonstrate different systems of large animals by using 3-D digital model	5	2
8	Present report by PowerPoint on different system of buffalo (Group	10	8

	work)		
9	Present different system of sheep by power point (Group work)	10	8
Total		**70**	**50**

Learning References

- Sastry, N. S. R., & Thomas, C. K. (2005). *Livestock production management* (4th ed.). Kalyani Publishers.
- Banerjee, G. C. (n.d.). *A textbook of animal husbandry* (8th ed.). Oxford and IBH Publishing Pvt. Ltd.
- Chakrabarti, A. (2007). *A textbook of preventive veterinary medicine*. Kalyani Publishers.
- Aspinall, V., & Cappello, M. (2015). *Introduction to veterinary anatomy and physiology*. Butterworth-Heinemann

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	**Pr.**	**Total**
Unit Hours	17		12	10	6	7	6	6	6	**-**	**70**
Marks	9		6	5	3	3	3	3	3	**5**	**40**

Mathematics

Course Code**:** AG-103-SH

Year: I

Total: 5 hours /week
Theory: 4 hours/week
Practical: 1 hour/week

Course description

This course equips learners with mathematical skills essential for agricultural applications. It consolidates foundational concepts and skills, emphasizing both qualitative and quantitative aspects of mathematics to solve agriculture related problems effectively.

Course objectives

Upon completion of this course, learners will be able to:

- Define Straight line, pair of lines, and circle
- Explain sets, relations, and functions
- Apply mathematical skills to solve problems in agriculture.
- Demonstrate the techniques, principles, and applications of differential calculus.
- Understand the real number system, complex numbers, and polynomial equations

Course content

Theory **140 Hrs.**

Unit 1 : Set theory and real number system **10 Hrs.**

1.1 Concepts of sets: specification, representation, and types,
1.2 Venn diagrams.
1.3 Real number system: types of numbers, real number line, absolute value, open and closed intervals.

Unit 2 : Relation and function **8 Hrs.**

2.1 Ordered pairs, cartesian product, relation, domain, and range.
2.2 Functions: types (surjective, injective, and bijective), inverse functions, composite functions
2.3 Applications in agriculture (e.g., modeling crop growth functions).

Unit 3 : Trigonometry **8 Hrs.**

3.1 Review of trigonometric functions.
3.2 General solutions of $\sin(x) = k$, $\cos(x) = k$, $\tan(x) = k$
3.3 Properties of triangles: sine law, cosine law, tangent law, and projection law. (statement and proofs only)
3.4 Applications in agriculture (e.g., calculating angles for irrigation channels)

Unit 4 : Polynomial equations **10 Hrs.**

4.1 Quadratic equations and the nature of their roots.

4.2 Relationship between roots and coefficients.

4.3 Applications in agriculture (e.g., optimizing fertilizer application rates).

Unit 5 : Co-ordinate geometry **22 Hrs.**

5.1 Straight lines 10 Hrs.

5.1.1 Three standard forms of equations of straight lines

5.1.2 Angles between two lines

5.1.3 Parallel and perpendicular lines

5.1.4 Point of intersection of lines

5.2 Pair of lines 8 Hrs.

5.2.1 Homogeneous equations of second degree

5.2.2 Angles and angle bisectors between pairs of lines (related problems only)

5.2.3 Conditions for a general second degree equation to represent a pair of lines

5.3 Circles 4 Hrs.

5.3.1 Equations of circles (center at origin, any point, touching x-axis and y-axis)

5.3.2 General equation of circle

Unit 6 : Calculus **20 Hrs.**

6.1 Limits and continuity (algebraic function only) define and simple cases of exponential and logarithm functions. 4 Hrs.

6.2 Derivatives 6 Hrs.

6.2.1 From first principle or from definition (algebraic function only)

6.2.2 From sum, power, product, quotient, chain, constant rules (algebraic function only)

6.3 Application of derivatives 6 Hrs.

6.3.1 Increasing and decreasing functions

6.3.2 Local maxima and minima

6.4 Antiderivatives 4 Hrs.

6.4.1 Indefinite integral: general integral (algebraic integral only)

6.4.2 Substitution method (algebraic function only)

Unit 7 : Statistics **34 Hrs.**

7.1 Introduction to statistics 8 Hrs.

7.1.1 Introduction, origin, meaning, definition, uses, role in agriculture, limitation and misuses of statistics

7.2 Organization of data 6 Hrs.

7.2.1 Organization of data, order arrays, frequency distribution, purpose of frequency distribution, frequency distribution of grouped data

7.2.2 Exclusive and inclusive type of classifications, conversion, mid value and class boundaries, principle of classification, guidelines to classify data

7.3 Presentation of data 6 Hrs.

7.3.1 Statistical diagrams, simple bar diagram, sub-divided bar diagram, percentage bar diagram, multiple bar diagram, pie-chart frequency curve and ogives

7.4 Measures of central tendency 7 Hrs.

7.4.1 Introduction, mean, median, mode, harmonic mean, geometric mean

7.5 Measures of Dispersion 7 Hrs.

7.4.1 Introduction, range, quartile deviation, mean deviation, standard deviation, variance, and coefficient of variation. (All the examples and problems of statistics should be related with agricultural field)

Unit 8 : Probability 8 Hrs.

8.1 Concepts of probability

8.2 Addition and multiplication theorem (Related problems only)

8.3 Random experiments, outcomes and sample spaces, total possible cases and favorable cases

8.4 Events: equally likely, mutually exclusive, exhaustive, independent, sure and impossible

Unit 9 : Vectors 6 Hrs.

9.1 Vectors and their types

9.2 Vectors in two and three dimensions

9.3 Unit vectors (i, j, k)

9.4 Collinear and coplanar vectors

Unit 10 : Matrices and determinants 8 Hrs.

10.1 Matrices and its operation (addition, subtraction and multiplication)

10.2 Transpose of a matrix, minors and cofactor, adjoint and inverse of a matrix. (2×2)

10.3 Determinants and their properties (without proof) upto 3×3

Unit 11 : Mensuration 6 Hrs.

11.1 Perimeter and area of triangle (skeleton, right angled, isosceles and equilateral)

11.2 Perimeter and area of quadrilateral (rectangle, square, parallelogram and rhombus)

11.3 Perimeter and area of circle and semi-circle

Practical 35 Hrs.

S.N.	List of Tasks	Hrs.
1	Prepare a grouped frequency distribution table.	3
2	Create a histogram and pie chart.	3
3	Construct a frequency polygon for data.	2
4	Draw a cumulative frequency curve.	3

5	Create a sub-divided bar diagram.	3
6	Draw percentage and multiple bar diagrams for data comparison.	3
7	Calculate mean deviation from mean.	3
8	Calculate mean deviation from mode and median.	3
9	Compute standard deviation and coefficient of variation	3
10	Solve co-ordinate geometry problems in space: find direction cosines and ratios and angle between two lines.	3
11	Apply mensuration to calculate area and perimeter of triangles, quadrilaterals and circles in agricultural field lay out.	3
12	Determine the equation of a plane through three points and the angle between two planes.	3
Total		**35**

Learning References

- Bajracharya, D. R., & Others. *Basic mathematics for grade XI and XII*. Sukunda Pustak Bhawan.
- Bajracharya, P. M., & Others. *Fundamentals of mathematics for grade XI and XII*. Buddha Academic Publishers and Distributors.
- Budhathoki, T. B., & Bhandari, T. R. *A textbook of mathematics I and II: For diploma in agriculture (plant and animal science)*. Heritage Publishers and Distributors.
- Maharjan, B. K. (2003). *Method of biostatistics* (16th ed.). In *Park's textbook of preventive and social medicine*.

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Total**
Unit Hours	10	8	8	10	22	20	34	8	6	8	6	**140**
Marks	6	5	5	6	12	10	18	5	4	5	4	**80**

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Physics

Course Code: AG-104-SH

Year: I **Total: 6 hours /week**
Theory: 4 hours/week
Practical: 2 hours/week

Course Description

This course provides an understanding of the scientific laws governing the physical world and their application. It emphasizes both quantitative and qualitative aspects of physics, using mathematical models and equations. The application of Physics to social and environmental situations is well illustrated. The practical component of this course is designed to supplement learning through the application of learned theory.

Course objectives

Upon completion of this course, learners will be able to:

- Relate physics to everyday experiences.
- Describe physics as a coherent framework of knowledge based on fundamental theories of physical structures and processes.
- Demonstrate skills in experimenting, observing, interpreting data, and evaluating evidence to formulate generalizations and models.
- Apply physical principles to various scenarios.
- Explain the definitions, laws, concepts, theories, and models in physics.
- Describe the applications and implications of physical facts and principles.

Course Contents

Theory **140 Hrs.**

Unit 1 : Mechanics **30 Hrs.**

1.1 Units and Measurement **3 Hrs.**

1.1.1 Definition of physical quantities, fundamental units, and derived units
1.1.2 Expressing derived units in terms of fundamental units
1.1.3 Dimensional formula for physical quantities
1.1.4 Main uses of dimensional equations with agricultural example (e.g., calculating irrigation flow rates).

1.2 : Scalars and Vectors **4 Hrs.**

1.2.1 Scalar and vector quantities
1.2.2 Vector addition by parallelogram and triangle methods
1.2.3 Resolving vectors into components with numerical examples
1.2.4 Dot and scalar product of vectors with numerical examples

1.3 : Kinematics **4 Hrs.**

1.3.1 Definitions of distance, displacement, speed, velocity, instantaneous velocity, and acceleration (retardation)

1.3.2 The concept of projectile motion
1.3.3 projectile fired from ground (cases: time of flight, maximum horizontal range only) and numerical
1.3.4 projectile fired from height (cases: time of flight, maximum horizontal range and maximum height only) and numerical

1.4 : Force **6 Hrs.**

1.4.1 Definition of Newton's laws of motion, inertia, impulse, and linear momentum
1.4.2 Principle of conservation of linear momentum with numerical examples
1.4.3 Angular displacement, velocity and acceleration
1.4.4 Relationship between linear and angular velocity
1.4.5 Centripetal acceleration, expression for centripetal force, centrifugal force and related numerical problems
1.4.6 Friction, normal reaction, angle of friction and coefficient of friction

1.5 : Work, Energy and Power **3 Hrs**.

1.5.1 Definition of work, energy and power
1.5.2 Differences between kinetic and potential energy, work against gravity & work against friction
1.5.3 Principle of conservation of energy for freely falling bodies with agricultural applications

1.6 : Gravity and Gravitation **3 Hrs.**

1.6.1 Concepts of gravitation, acceleration due to gravity, mass, weight, and weightlessness
1.6.2 Variation of 'g' due to altitude and depth
1.6.3 Definition of Center of mass, center of gravity, satellite, orbital velocity, and escape velocity

1.7 : Hydrostatics **3 Hrs.**

1.7.1 Definition: pressure, upthrust, density, relative density/specific gravity
1.7.2 Mathematical relation for liquid pressure
1.7.3 Statements and application of Pascal's law (no derivation), Archimedes' principle (no derivation) and principle of floatation

1.8 : Properties of Matter **4 Hrs.**

1.8.1 Hook's law (no verification)
1.8.2 Stress, strain and elasticity of solid material, numerical of young's modulus
1.8.3 Elastic potential energy and energy density in a stretched wire energy & numerical
1.8.4 Definition of surface tension of liquid, adhesive and cohesive forces
1.8.5 Capillary action and its examples (No derivation)
1.8.6 Definition of Viscosity & Newton's formula of viscosity

Unit 2 : Heat **22 Hrs.**

2.1 : Thermometry **3 Hrs.**

2.1.1 Concepts of heat and temperature

2.1.2 Definitions of thermometer, thermal equilibrium, zeroth law, absolute zero
2.1.3 Relationship between temperature scales with numerical examples

2.2 : Thermal Expansion **5 Hrs.**

2.2.1 Linear, superficial, and cubical expansion of solids and related numerical
2.2.2 Derivation of $\Upsilon = 3\alpha$ and $\beta = 2\alpha$
2.2.3 Apparent and real expansion of a liquid (Omit derivation)
2.2.4 Anomalous expansion of water: definition, importance, and its effects

2.3 : Calorimetry **4 Hrs.**

2.3.1 Definitions of Heat capacity, specific heat capacity, and latent heat
2.3.2 Principle of calorimetry, phase transitions
2.3.3 Simple numerical problems of phase transition

2.4 : Transfer of Heat **5 Hrs.**

2.4.1 Methods of heat transfer by conduction, convection, and radiation
2.4.2 Thermal conductivity and its numerical
2.4.3 Black body and black body radiation
2.4.4 Stefan's law of blackbody radiation

2.5 : Thermodynamics **5 Hrs.**

2.5.1 Definition of work done by gas, internal energy, isothermal, and adiabatic process
2.5.2 First law of thermodynamics and its limitations
2.5.3 Definition of molar heat capacity at constant volume and pressure
2.5.4 Mayer's formula derivation
2.5.5 Statement of the second law of thermodynamics (Kelvin statement & Clausius)

Unit 3 : Light **20 Hrs.**

3.1 : Reflection of Light **6 Hrs.**

3.1.1 Reflection and laws of reflection
3.1.2 Images formed by a plane mirror, real and virtual image
3.1.3 Mirror formula using concave and convex lenses
3.1.4 Simple numerical problems of concave and convex mirror

3.2 : Refraction **6 Hrs.**

3.2.1 Refraction and laws of refraction
3.2.2 Refractive index
3.2.3 Relationship between real depth and apparent depth with numerical examples
3.2.4 Critical angle and total internal refraction
3.2.5 Lenses, lens formula (No derivation)
3.2.6 Simple numerical problem of lens and critical angle

3.3 : Optical Instruments **4 Hrs.**

3.3.1 Defects of vision, causes and remedy (no derivation)
3.3.2 Definition and use of astronomical telescope, simple microscopes and compound microscopes

3.3.3 Basic concept on interference and diffraction

3.4 : Prism **4 Hrs.**

3.4.1 Definition of a prism
3.4.2 Derivation of the refractive index of a prism
3.4.3 Simple numerical problems

Unit 4 : Waves and Sound **10 Hrs.**

4.1 : Waves **5 Hrs.**

4.1.1 Longitudinal and transverse waves
4.1.2 Path difference and phase difference
4.1.3 Equations of progressive wave
4.1.4 Superposition of waves, stationary wave (without condition for amplitude)

4.2 : Characteristics of Sound Waves **5 Hrs.**

4.2.1 Velocity of sound in air with numerical examples
4.2.2 Newton's formula and Laplace's correction (no derivation for Laplace equation)
4.2.3 Factors affecting velocity of sound
4.2.4 Definition of tone, note, harmonics, overtone, open and close organ pipes
4.2.5 Resonance and its consequences

Unit 5 : Electrostatics **8 Hrs.**

5.1 : Fundamentals of Electrostatics

5.1.1 Charges and their properties
5.1.2 Electrification by friction, conduction, and induction (modern theory)
5.1.3 Coulomb's law in electrostatics and related numerical problems
5.1.4 Electric field, electric field intensity, and normal electric flux
5.1.5 Electric Potential and electric potential energy
5.1.6 Capacitors: uses and capacitance concepts
5.1.7 Electron volt and its applications

Unit 6 : Magnetism **15 Hrs.**

6.1 : Fundamentals of Magnetism **10 Hrs.**

6.1.1 Geometrical and effective length, magnetic moment, pole strength of magnets
6.1.2 Coulomb's law for magnetism
6.1.3 Magnetic field intensity due to bar magnet at (a) end on position, (b) broad side on position
6.1.4 Magnetic lines of force
6.1.5 Neutral point
6.1.6 Simple numerical problems of Coulomb's law, magnetic field intensity

6.2 : Terrestrial Magnetism **5 Hrs.**

6.2.1 Angle of dip, declination, horizontal and vertical components of Earth's magnetic field
6.2.2 Properties of Dia, para, and ferromagnetic substances
6.2.3 Domain theory of ferromagnetism

6.2.4 Simple numerical problems of component of earth's magnetic field

Unit 7 : Current Electricity **18 Hrs.**

7.1 : Electric current **5 Hrs.**

7.1.1 Current as the rate of charge flow
7.1.2 Potential difference
7.1.3 Ohm's law statement
7.1.4 Resistance and resistivity
7.1.5 Series and parallel combination of resistances with simple numerical problems
7.1.6 Galvanometer and its conversion into ammeter and voltmeter with simple numerical problems

7.2 : Electrical Measurement **2 Hrs.**

7.2.1 Kirchhoff's laws (no verification)
7.2.2 Wheatstone bridge

7.3 : Resistance and Heat **4 Hrs.**

7.3.1 Joule's laws of heating with mathematical relations
7.3.2 Heat production in resistance wire due to passage of current
7.3.3 EMF, terminal potential difference, internal resistance relationships
7.3.4 Definition of electric power, watts, kilowatts, kilowatt-hour and horsepower

7.4 : Electromagnetism **4 Hrs.**

7.4.1 Oersted's discovery
7.4.2 Direction of electric current and magnetic field
7.4.3 Force on a moving charge in uniform magnetic field with simple numerical problems
7.4.4 Force on a current carrying conductor in uniform magnetic field with simple numerical problems
7.4.5 Electromagnetic induction, Magnetic flux, Faraday's laws

7.5 : Alternating Current **3 Hrs.**

7.5.1 AC vs. DC: merits and demerits
7.5.2 Instantaneous and peak AC
7.5.3 Mean value of AC
7.5.4 Reactance and impedance for different AC circuits (no derivation)
7.5.5 Introduction of dynamo, AC generator, transformer
7.5.6 Eddy current and applications

Unit 8 : Modern Physics **17 Hrs.**

8.1 : Electron **3 Hrs.**

8.1.1 Definition and properties of cathode rays
8.1.2 Motion of electron in electric field and magnetic fields with simple numerical problems
8.1.3 Specific charge of an electron (introduction)

8.2 : Photoelectricity **4 Hrs.**

8.2.1 Photoelectric effect and quantum theory of radiation
8.2.2 Definition of work function, threshold wavelength, threshold frequency and stopping potential
8.2.3 Einstein's photoelectric equation with numerical problems
8.2.4 Postulates of Bohr's atomic model, definition of wave particle duality

8.3 : X-ray **1 Hrs.**

8.3.1 Definition, properties and uses of X-rays
8.3.2 Control of intensity and quality

8.4 : Radioactivity **5 Hrs.**

8.4.1 Basic concept of radioactivity
8.4.2 Definition and properties of α-rays, β-rays and γ-rays
8.4.3 Laws of radioactive disintegration and derivation of decay equation
8.4.4 Relationship between half-life, decay constant, mean life
8.4.5 Harmful and useful aspects of radiation and its precautions
8.4.6 Simple numerical problems

8.5 : Properties of Nucleus **3 Hrs.**

8.5.1 Nuclear properties and concepts
8.5.2 Definition of isotopes, isobars, and isotones
8.5.3 Mass defect, binding energy, and their relationships
8.5.4 Einstein's mass energy relation theory
8.5.5 Atomic mass unit
8.5.6 Nuclear Fission and nuclear fusion reactions

8.6 : Physics and Society **1 Hrs.**

8.5.7 Greenhouse effect: concepts, harmful, and useful aspects with agricultural applications (e.g., greenhouse farming).

Practical **70 Hrs.**

S.N.	List of Tasks	Hrs.
1	Measure the volume and density of a hollow cylinder using vernier calipers.	4
2	Determine the volume of a steel ball using a micrometer screw gauge	4
3	Measure the thickness of glass plate using a spherometer.	4
4	Determine the acceleration due to gravity using a simple pendulum	4
5	Verify the laws of reflection of light and determine the relationship between object and image distance using a plane mirror.	4
6	Verify the laws of rotation of light.	3

7	Plot the angles of deviation (ID) curve through a prism and calculate its refractive index.	4
8	Demonstrate the variation of lateral displacement with an angle of incidence in a rectangular slab.	4
9	Determine the latent heat of fusion of ice using the method of mixtures.	4
10	Determine the melting point of wax using the cooling curve method.	4
11	Measure the magnetic moment and pole- strength of a bar magnet by locating neutral points (N-pole pointing south).	4
12	Determine the magnetic moment and pole- strength of a bar magnet by locating neutral points (N-pole pointing north).	4
13	Verify Ohm's law using a simple circuit.	3
14	Determine the unknown resistance of a wire by using the meter bridge.	4
15	Measure the velocity of sound in air at NTP using resonance tube apparatus.	4
16	Determine the angle of dip in the laboratory using a dip circle.	4
17	Determine frequency of an AC source using a sonometer.	4
18	Determine the coefficient of viscosity of a liquid using stokes' method.	4
Total		**70**

Learning References

- Halliday, D., & Resnick, R. *Physics* (Parts I & II).
- Pradhan, J. M., & Gupta, S. K. *A textbook of physics* (Parts I & II).
- Sears, F. W., Zemansky, M. W., & Young, H. D. (n.d.). *University physics*.
- Verma, H. C. *Concepts of physics* (Volumes I & II).

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Unit Hours	30	22	20	10	8	15	18	17	**140**
Marks	16	14	12	6	5	8	10	9	**80**

Chemistry

Course Code: AG-105-SH

Year: I

Total: 6 hours /week
Theory: 4 hours/week
Practical: 2 hours/week

Course Description:
This course provides an understanding of the scientific laws of chemistry and how chemistry contributes to life's activities in modern society. It emphasizes both quantitative and qualitative aspects of chemistry through chemical formula and equations. The application of chemistry to social and environmental situations is well illustrated. The practical component of this course is designed to supplement learning through the application of learned theory.

Course objectives:
Upon completion of this course, learners will be able to:

- Explore concepts in physical, organic, and inorganic chemistry.
- Develop chemistry skills, knowledge and attitudes through practical activities.
- Encourage in inquiry-based chemistry and explore its applications in various fields.
- Prepare practical reports using appropriate methods and approaches.
- Interpret basic principles related to plant & animal health, soil composition, nutrient absorption, animal physiology and other agricultural sectors.
- Explain environmental chemistry, including sources, effects, and control measures for atmospheric pollutants.

Course Contents

Theory **140 Hrs.**

Part I: Physical and General Chemistry **62 Hrs.**

Unit 1 : Introduction to Chemistry **9 Hrs.**

1.1 General concept of chemistry
1.2 Importance and scope of chemistry
1.3 Introduction of elements and compounds
1.4 Definition with examples of atoms, molecules, symbols, and formulas (molecular and empirical formulas).
1.5 Introduction of Radical
1.6 Significance of symbols and molecular formulas
1.7 Chemical equations: reactants and products
1.8 Description of seven types of chemical reactions with examples.
1.9 Significance and limitations of chemical equations
1.10 Balancing chemical equations by hit & trial method.

Unit 2 : Atomic Structure **6 Hrs.**

2.1 Introduction of sub-atomic particles (electron, proton, and neutron).
2.2 Description of Rutherford's nuclear model of the atom.
2.3 Description of Bohr's atomic model.

2.4 Description with examples of atomic number, mass number, atomic weight, and gram atomic weight.
2.5 Arrangement of electrons in orbits (Aufbau principle).

Unit 3 : Classification of elements and periodic properties 5 Hrs.

3.1 Definition of Mendeleev's periodic law.
3.2 Description of Modern periodic law and the modern periodic table.
3.3 Classification of elements into different groups, periods and blocks.
3.4 Periodicity in properties by atomic radii, ionization potential, electron affinity and electronegativity.

Unit 4 : Chemical bonding 4 Hrs.

4.1 Electronic theory of valency.
4.2 Introduction of valence electron, duplet, octet, noble gas, and electronic configuration.
4.3 Types of bonds: electrovalent, covalent, and coordinate covalent.

Unit 5 : States of matter - Gaseous state 6 Hrs.

5.1 Kinetic theory of gases (Postulates only).
5.2 State and explain Boyle's Law & Charles' Law.
5.3 Simple derivation of the Ideal gas equation.
5.4 Diffusion of gas.
5.5 Simple numerical calculation of Boyle's law, Charles' law, and Ideal gas equation.

Unit 6 : States of matter - Liquid state 6 Hrs.

6.1 Physical properties of liquids: evaporation and condensation.
6.2 Introduction of vapor pressure, boiling point, surface tension and viscosity.
6.3 Introduction of solution (unsaturated, saturated and supersaturated solution).
6.4 Description of solubility, solubility curve and simple related numerical

Unit 7 : States of matter - Solid state 2 Hrs.

7.1 Differentiate between amorphous and crystalline solids.
7.2 Introduction to efflorescent, deliquescent, hygroscopic solids, isomorphism and water of crystallization.

Unit 8 : Oxidation and Reduction 7 Hrs.

8.1 Classical Concept of oxidation and reduction.
8.2 Electronic concept of oxidation and reduction.
8.3 Introduction of oxidant, reductant, and oxidation number.
8.4 Calculation of oxidation number.
8.5 Examples of redox reactions.
8.6 Balancing the chemical equation by oxidation number method.

Unit 9 : Acid, Base, and Salt 4 Hrs.

9.1 Description of theories of acid and base (Arrhenius's theory, Bronsted-Lowery theory, and Lewis's concept)
9.2 Salts and their types.
9.3 Examples of acid and base found in plants and their roles.

Unit 10 : Electro Chemistry **7 Hrs.**

10.1 Introduction with examples of electrolytes, non-electrolytes, strong electrolytes and weak electrolytes.
10.2 State and explain Faradays' laws of electrolysis.
10.3 Description of electrolysis of water.
10.4 Introduction of PH, POH and buffer solution. (simple numerical P^H related)
10.5 Importance of PH and buffer in the human body.

Unit 11 : Volumetric analysis **6 Hrs.**

11.1 Introduction of equivalent and gram equivalent weight of element.
11.2 Introduction of titration, acidimetry, alkalimetry, endpoint, indicator, primary and secondary standard substance.
11.3 Ways of expressing the concentration of the solution in terms of normality, molarity, molality, and %.
11.4 Normality equation.
11.5 Calculations to prepare different concentrations of solutions. (prepare different concentrations……N/2, N/10, N/20, N/100 of sodium carbonate, oxalic acid, sulphuric acid, and sodium hydroxide)

Part II: Inorganic and Environmental Chemistry **33 Hrs.**

Unit 1 : Water **5 Hrs.**

1.1 Introduction of soft and hard water.
1.2 Removal of water hardness: boiling, Clark's process, washing soda, permutit process.
1.3 Methods of drinking water purification.
1.4 Advantages and disadvantages of hard water.

Unit 2 : Metals **7 Hrs.**

2.1 Differences between metals and non-metals
2.2 Occurrence of metals, general metallurgy of metals "crushing and dressing'', calcination and roasting, reduction with carbon (only introduction for all)
2.3 Sodium: Physical and chemical properties (action with air, water, non-metals, and NH3).
2.4 Copper: Physical and chemical properties (action with H2SO4 and HNO3).
2.5 Zinc: Physical and chemical properties (action with HCl, HNO3, H2SO4, water, air, and alkali) and galvanization.
2.6 Iron: physical and chemical properties (action with HCl, HNO3, H2SO4, water, and halogen) and rusting of iron.

Unit 3 : Non-Metals **8 Hrs.**

3.1 Hydrogen:
3.1.1 Physical and chemical properties (reaction with O_2, Na, Ca, X_2 and N_2)
3.1.2 Introduction of vegetable oil and heavy water,
3.1.3 Isotopes and uses of hydrogen.

3.2 Oxygen:

3.2.1 Physical and chemical properties (reaction with Ag, Na, H_2, SO_2, NH_3 and N_2)
3.2.2 Uses of oxygen.

3.3 Nitrogen:
3.3.1 Manufacture of ammonia by Haber's process (principle with a diagrammatic sketch).
3.3.2 Physical and chemical properties of ammonia (action with metals, basic nature),
3.3.3 Uses of ammonia in agriculture.

3.4 Carbon:
3.4.1 Description of allotropes of carbon (graphite and diamond)
3.4.2 Physical and chemical properties of carbon dioxide (reaction with Na, Mg, H_2O and lime water),
3.4.3 Uses of carbon dioxide.

3.5 Halogens: General characteristics of halogens.

Unit 4 : Acids, Chemical Fertilizers and Minerals 7 Hrs.

4.1 Nitric acid: Manufacture of nitric acid by Ostwald process (principle with a diagrammatic sketch), physical and chemical properties (action with Zn, Cu, and salts).
4.2 Hydrochloric acid: physical properties, acidic nature, chemical properties (action with ammonia, silver nitrate, and salts), and uses.
4.3 Description of NPK fertilizer.
4.4 Differentiate between natural and artificial fertilizers.
4.5 Role of NPK fertilizer in the plant.
4.6 Listing advantages and disadvantages of chemical fertilizer.
4.7 Sources, biological importance and effects due to their deficiency of the following minerals - Na, K, Ca, Mg, Fe, Zn, Ni, Cobalt

Unit 5 : Environmental Chemistry 6 Hrs.

5.1 Introduction and sources of air pollution and its effects on agriculture.
5.2 Introduction and effects of water pollution.
5.3 Description of soil pollution and solid waste management
5.4 Introduction, causes, adverse effects and control measures of the greenhouse effect, ozone layer depletion and acid rain.

Part: III Organic Chemistry 45 Hrs.

Unit 1 : Introduction to Organic Compounds 10 Hrs.

1.1 Description of "organic chemistry is a separate branch and the reason for the large number of organic compounds''.
1.2 Difference between organic and inorganic compounds.
1.3 Sources of organic compounds.
1.4 Functional group and homologous series.
1.5 IUPAC system of nomenclature for aliphatic compounds with and without functional groups
1.6 Structural isomerism in organic compounds.
1.7 Carbocation, carbanion, electrophiles, and nucleophiles.
1.8 Importance of organic compounds in agriculture (antipyretics, analgesics, antibiotics,

antimalarial, tranquilizers, germicides, and antiseptics found in plants)

Unit 2 : Hydrocarbons **6 Hrs.**

2.1 Introduction of saturated and unsaturated hydrocarbons.
2.2 Laboratory preparation of ethene from ethanol.
2.3 Chemical properties and uses of alkenes.
2.4 Markovnikov's and anti-Markovnikov's rule.
2.5 Laboratory preparation of ethyne from calcium carbide.
2.6 Chemical properties of hydrocarbon (Combustion, hydrogenation, catalytic hydration, with Br_2 solution, with Na, polymerization).
2.7 Uses of hydrocarbons.

Unit 3 : Alkyl Halides **2 Hrs.**

3.1 Introduction of alkyl halides with examples.
3.2 Uses of alkyl halides.

Unit 4 : Alcohol **5 Hrs.**

4.1 Classification: primary, secondary and tertiary alcohols.
4.2 Physical and chemical properties of ethyl alcohol (oxidation, with sodium, H2SO4, CH3COCl, CH3COOH, CH3COOH and combustion).

Unit 5 : Aldehyde and Ketones **4 Hrs.**

5.1 General methods of preparation of aldehydes and ketone.
5.2 Chemical properties (with ammonia, with NH4OH, NaOH, Polymerization)
5.3 Uses in everyday life.

Unit 6 : Carboxylic acid **4 Hrs.**

6.1 Preparation of carboxylic acid from acetylene and ethanol.
6.2 Physical and chemical properties of acetic acid (with NaHSO3, NH3, C2H5OH, PCl5, acidic character).
6.3 Natural sources of acetic acid.
6.4 Uses in Everyday Life.

Unit 7 : Ethers **4 Hrs.**

7.1 Laboratory preparation of ether from ethanol (reaction and diagram only).
7.2 Physical properties and chemical properties (Combustion, hydrolysis).
7.3 Reaction with excess HI and PCl_5.
7.4 Uses in medicine and everyday life.

Unit 8 : Aromatic Compounds **4 Hrs.**

8.1 Introduction and characteristics of aromatic compounds.
8.2 Differences between aliphatic and aromatic compounds.
8.3 Kekule's structure of benzene.
8.4 Uses of benzene in everyday life.

Unit 9 : Phenol **4 Hrs.**

9.1 Preparation of phenol from benzene diazonium chloride and sodium benzene

sulphonate.

9.2 Physical and chemical properties (action with Na, Zn, NH3, benzene diazonium chloride,

9.3 Kolbe's reaction.

Unit 10 : Natural Products Chemistry **2 Hrs.**

10.1 List of medicinal plants found in Nepal.

10.2 Description of phytochemical technique; extraction, isolation, purification and characterization of natural products.

Practical: **70 Hrs.**

S.N.	List of Tasks	Hrs.
1.	Develop procedural rules and guidelines for the chemistry laboratory.	2
2.	Establish lab safety protocols and first aid measures for chemistry labs.	4
3.	Document laboratory procedures and maintain laboratory records.	3
4.	Handle chemistry lab equipment.	4
5.	Cut and bend glass tubes at various angles and prepare a delivery tube for gas collection.	2
6.	Perform filtration to separate mixtures. (sand and salts)	2
7.	Conduct sublimation to purify substances. (sand and Camphor)	2
8.	Perform precipitation reactions and observe precipitate formation.	2
9.	Perform distillation to separate liquids.	3
10.	Conduct evaporation processes for sample concentration.	2
11.	Conduct crystallization processes for substance purification.	2
12.	Perform acid-base reactions and study their properties.	4
13.	Prepare and study the properties of gases (hydrogen, ammonia, and carbon dioxide) in the lab.	6
14.	Determine the equivalent weight of a metal using the hydrogen displacement method.	3
15.	Conduct acid-base titrations to determine solution strengths.	4

16.	Detect the acid radicals (Cl^-, NO_3^{--} , SO_4^{--} , CO_3^{--}) using dry and wet tests.	6
17.	Detect the basic radicals (Cu^{++}, Al^{+++}, Fe^{+++}, Zn^{++}) using wet tests.	4
18.	Prepare solutions of various strengths and concentrations.	4
19.	Detect the presence of nitrogen, sulphur, and halogens in organic compounds.	4
20.	Identify functional groups in organic compounds.	4
21.	Measure pH values of soil samples using PH meter.	3
Total		**70**

Learning References

- Jha, J. S., & Gugliani, S. K. *A textbook of chemistry* (Current ed.). Seirya Publication.
- Sthapit, M., & Pradhananga, R. R. *Fundamentals of chemistry* (Vols. I & II, Current ed.). Taleju Prakashan.
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Final written exam marking scheme

Part	Unit	Unit Hours	Marks
I	1.	9	**6**
	2.	6	**3**
	3.	5	**3**
	4.	4	**3**
	5.	6	**4**
	6.	6	**3**
	7.	2	**2**
	8.	7	**3**
	9.	4	**2**
	10.	7	**4**
	11.	6	**3**
II	1.	5	**2**
	2.	7	**5**
	3.	8	**5**
	4.	7	**4**
	5.	6	**4**
III	1.	10	**6**
	2.	6	**5**
	3.	2	**1**
	4.	5	**2**
	5.	4	**2**
	6.	4	**2**
	7.	4	**2**
	8.	4	**2**
	9.	4	**1**
	10.	2	**1**
Total		**140**	**80**

Zoology

Course Code: AG-106-SH

Year: I

Total: 5 hours /week
Theory: 3 hours/week
Practical: 2 hours/week

Course description

This course provides a fundamental understanding of the characteristics of unicellular, multicellular structures, cell biology, and different types of tissues. It covers animal diversity, and evolution of organisms, anatomy and physiology of earthworms, and economically important insects. It also explores the interaction between organisms and environment, detailed study of the anatomy and physiology of mammals, behavior of animals in response to environment.

Course Objectives

Upon completion of this course, learners will be able to:

- Identify common organisms by their local Nepali, common English, and scientific names.
- Define the meaning, scope, and branches of zoology.
- Describe the structure of cells and explain the functions of different body tissues.
- Classify various forms of animal life.
- Analyze the anatomical and physiological characteristics of mammals.

Course Contents

Theory **105 Hrs.**

Unit 1 : Introduction to Zoology **4 Hrs.**

1.1 Definition and Scope of Zoology

1.2 Branches of Zoology (Morphology, Anatomy, Physiology, Cytology, Histology, Embryology, Hematology, herpetology, Parasitology, Entomology, Helminthology, Proto-zoology, Bacteriology, Virology, Paleontology, Ecology, Genetics, Toxicology)

1.3 Relationship of zoology with other sciences (Physics, Chemistry and Statistics)

1.4 Preservation Techniques

1.4.1 Definition and importance of preservation

1.4.2 Wet and dry methods of preservation

1.4.3 Protocols for preserving zoological specimens

Unit 2 : Cell Biology **11 Hrs.**

2.1 Introduction to Cells 4 Hrs.

2.1.1 Definition and structure of cells: general, plant, and animal cells

2.1.2 Cell as a basic unit of life**.**

2.1.3 Differentiation of: plant and animal cell, prokaryotic and eukaryotic cell

2.1.4 Functions of cell organelles: Cell membrane, mitochondria, endoplasmic reticulum, Golgi complex, liposome, centrosome, vacuoles, cilia and flagella, chromosomes, nucleolus, nuclear membrane

2.2 Cell Division 7 Hrs.

2.2.1 Definition of cell cycle and explanation of the stages of cell cycle

2.2.2 Types of cell division: Amitosis, mitosis and meiosis

2.2.3 Significance of amitosis, mitosis and meiosis

2.2.4 Why Meiosis cell division is also known as reduction cell division?

2.2.5 Differences between mitosis and meiosis.

Unit 3 : Study of Microscope 3 Hrs.

3.1 Definition and importance of microscopes and its types

3.2 Explanation of: parts and functions, observation techniques, handling and magnification concepts

Unit 4 : Tissues and Their Types 6 Hrs.

4.1 Definition of tissues

4.2 Types and functions of tissues: epithelial, connective, muscular and nervous

4.3 Structure, types, function, and location of Connective, muscular, and nervous tissues in human body

Unit 5 : Diversity of Animal Life 6 Hrs.

5.1 Concept of Taxonomy 2 Hrs.

5.1.1 Definition of taxonomy, higher taxon, and lower taxa

5.1.2 Species as the basic unit of classification

5.1.3 Types of classification: artificial, natural, and modern systems

5.1.4 Differences between artificial and natural classification

5.2 Binomial Nomenclature and Classification 4 Hrs.

5.2.1 Nomenclature and Linnaeus's binomial system (1707- 1778)

5.2.2 Listing of the importance of nomenclature

5.2.3 Listing of scientific names of commonly found animals (Dog, Cat, Goat, Cow, Buffalo, Pig, Lion, Tiger, Deer, Leopard, Elephant, Pigeon, Parrot, Crow, Rat,

5.2.4 Characteristics and listing of the five kingdoms classification.

Unit 6 : Animal Phylogeny and Classification 6 Hrs.

6.1 General characteristics and classification of animal phyla with examples: Protozoa, Porifera, Coelenterate, Platyhelminthes, Aschelminths, Annelida, Arthropod, Mollusca, Echinodermata and Chordata

Unit 7 : Origin and Evolution of Life **10 Hrs.**

7.1 Definition of evolution and organic evolution (with examples).

7.2 Evidence of organic evolution from: Morphological and Anatomical, Paleontological, Biochemical, Genetic and Embryological

7.3 Theories of organic evolution

7.3.1 Lamarck′s theory of evolution: concept, examples, and drawbacks

7.3.2 Darwin's theory of natural selection: concept, examples and drawbacks,

7.3.3 Neo-Darwinism/ Modern Synthetic Theory: integration of genetics with examples.

7.4 Human evolution stages and key features: Dryopithecus; Ramapithecus; Shivapithecus; Australopithecus; Modern human ancestors such as Homo habilius; Homo erectus; Java man (Homo erectus); Peking man (Homo erectus pekinensis); Neanderthal man (Homo sapiens neanderthalensis); Cro-Magnon man; Modern man

Unit 8 : Study of Earthworm **6 Hrs.**

8.1 Systematic position, habit and habitat of earthworm

8.2 Morphology of earthworm with labeled sketches.

8.3 Earthworm is known as farmer′s friends. Why?

8.4 Digestive system and physiology of digestion in earthworm.

8.5 Male and female reproductive organs of earthworm.

8.6 Vermicomposting: definition, mechanism and benefits for agriculture

8.7 Economic importance of earthworms.

Unit 9 : Study of Economically Important Insects **9 Hrs.**

9.1 Systematic position, habit, habitat, morphology and lifecycles of honeybee, silkworm, liver fluke and tapeworm

9.2 Commercial honeybee cultivation in Nepal: apiary management and pollination benefits

9.3 Silkworm rearing in Nepal: sericulture practices

9.4 Economic importance of honeybees and silkworms.

9.5 Characters of silk thread.

Unit 10 : Study of Life Process in Mammals **20 Hrs.**

10.1 Systematic position of humans

10.2 Structure and physiology of: digestive system, respiratory system, circulatory system, reproductive system, excretory system

10.3 Endocrine System- Glands (hypothalamus, pituitary, thyroid, parathyroid, adrenals, pineal body, ovaries and testes) and their major role in human body

10.4 Nervous system: basic structure and organs and major functions in human body

Unit 11 : Ecosystem **8 Hrs.**

11.1 Introduction to ecosystem

11.1.1 Definition and types: aquatic and terrestrial ecosystem
11.1.2 Abiotic and biotic factors of different ecosystem
11.1.3 Food chains: definition and diagrammatic representation
11.1.4 Ecological pyramids and trophic level with sketches
11.1.5 Description of energy, energy flow and relations in ecosystem

11.2 Bio-geochemical cycles 4 Hrs.

11.2.1 Definition of biogeochemical cycle.
11.2.2 Description of carbon cycle, water cycle, oxygen cycle and nitrogen cycle

11.3 Environmental Pollution 4 Hrs.

11.3.1 Definition and types of pollution
11.3.2 Biodegradable and non-biodegradable pollutants with examples
11.3.3 Water, air and soil pollution: sources, effects and preventive measures
11.3.4 Introduction, importance and techniques of solid waste management

Unit 12 :Animal Adaptation 4 Hrs.

12.1 Introduction to animal adaptation
12.2 Definition of aquatic and terrestrial adaptation with examples
12.3 Description of adaptation features of aquatic and terrestrial adaptation with examples

Unit 13 :Animal Behavior 4 Hrs.

13.1 Definitions: reflex action, taxis, photo taxis, chemotaxis, geotaxis, thermotaxis, rheotaxis, galvanotaxis, thigmotaxis, leadership and qualities of a leader, behavior, learned behavior and innate behavior
13.2 Listing of some common examples of leadership in animals

Unit 14 :Conservation of Wildlife 8 Hrs.

14.1 Definition of wildlife
14.2 Methods and importance of wildlife conservation
14.3 Description of conservation strategies for wildlife
14.4 IUCN classifications: Extinct (EX), critically endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Threatened Species
14.5 Listing of the rare, threatened, and endangered species in Nepal
14.6 Role of IUCN and causes of wildlife extinction in Nepal
14.7 Explanation of the national parks and wildlife reserves of Nepal
14.8 Definition of afforestation and its importance
14.9 Role of forest conservation in wildlife protection
14.10 Causes and Consequences of deforestation

Practical **70 Hrs.**

S.N.	List of Tasks	Hrs.
1.	Preserve organisms from different groups (lower invertebrates, higher invertebrates: arthropoda, mollusca, echinodermata; vertebrates) using dry and wet preservation techniques.	4
2.	Observe permanent slides and museum specimens (invertebrata- paramecium amoeba, plasmodium and its lifecycle; round worm and its lifecycle; liver fluke; earthworm; leech; common athropoda specimens; snail; starfish. chordata- rohu, flying fish; frog; lizard; snake; parrot; rat, pigeon	10
3.	Observe animal tissues microscopically using permanent slides.	4
4.	Dissect an earthworm to study its general anatomy, alimentary canal, reproductive system; draw labeled diagrams.	4
5.	Prepare a temporary mount of earthworm setae.	2
6.	Dissect a rat to examine its general anatomy alimentary canal and associated glands, circulatory system, reproductive system, brain; draw labeled diagrams.	14
7.	Dissect a frog to study its general anatomy, alimentary canal, reproductive system, and circulatory system; draw labeled diagrams.	10
8.	Study abiotic and biotic factors of an aquatic ecosystem.	2
9.	Study an aquarium as a model pond ecosystem, identifying key components.	2
10.	Identify a food chain in an aquarium.	2
11.	Study abiotic and biotic factors of an agricultural ecosystem as a terrestrial ecosystem.	4
12.	Identify common insects and animals in an agricultural ecosystem.	4
13.	Identify a food chain in an agricultural ecosystem.	2
14.	Enlist and describe terrestrial adaptations (aerial, desert, arboreal, fossorial, cursorial) with examples.	4
15.	Study the principles of the International Code of Zoological Nomenclature (ICZN) for naming species.	2
Total		**70**

Learning References

- Bam, A. K., Jha, B. S., Subedi, J. R., Shah, R. B., & Jha, D. B. *Zoology for agriculture with practical*. Advance Ayam Publication.
- Keshari, A. *A textbook of zoology for health sciences*. Vidyarthi Pustak Bhandar.
- Kotpal, R. L. *Modern textbook of zoology: Invertebrates*. Rastogi Publications.
- Kotpal, R. L. *Modern textbook of zoology: Vertebrates*. Rastogi Publications.
- Keshari, A. *Practical biology*. Vidyarthi Publication.
- Verma, P. S. *Practical zoology: Invertebrate*. S. Chand & Company Pvt. Ltd.
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Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**Total**
Unit Hours	4	11	3	6	6	6	10	6	9	20	8	4	4	8	**105**
Marks	3	8	2	4	4	4	8	4	7	18	6	3	3	6	**80**

Botany

Subject Code: AG-107-SH

Year: I **Total: 5 hours /week**
Theory: 3 hours/week
Practical: 2 hours/week

Course description:

This course introduces fundamental botanical concepts, including plant anatomy, physiology, taxonomy, biodiversity, and molecular biology. It covers major plant groups (algae to angiosperms), plant genetics, and embryology, emphasizing their relevance in modern agriculture. It also includes economic botany, ethnobotany, and biotechnology applications such as tissue culture and genetic engineering for crop improvement.

Course objectives:

Upon completion of this course, learners will be able to:

- Explain the importance of botany and its interrelation with other sciences.
- Describe the structure of plants at molecular, cellular, tissue and organ levels.
- Analyze basic anatomical features and physiological process in plants.
- Explain the characteristics of various organisms.
- Diagnose the cause of a plant's disease and recommend management strategies.

Course contents

Theory **105 Hrs.**

Unit 1 : Introduction to Botany **4 Hrs.**

1.1 Meaning and definition of botany
1.2 Scope and importance of botany
1.3 Branches of Botany (special and normal)
1.4 Relationship of botany with chemistry and agricultural science

Unit 2 : Molecular Biology **9 Hrs.**

2.1 Concept of biomolecules with examples
2.2 Definition, examples, and differentiation of macro and micro molecules
2.3 Definition, types, examples, and functions of Carbohydrates
2.4 Definition of amino acid, essential and nonessential amino acid, Protein, types, function, denaturation, and renaturation of protein
2.5 Definition, types, and functions of lipids
2.6 Definition of nucleic acids, types, structure, function and differences between DNA and RNA
2.7 Application of molecular biology in agriculture

Unit 3 : Plant Anatomy **8 Hrs.**

3.1 Tissues: definition, types and functions.
3.2 Meristematic tissues: types and function based on location.

3.3 Permanent tissues: types and functions
3.4 Internal Structure of dicot and monocot leaves and stems

Unit 4 : Plant Physiology 12 Hrs.

4.1 Diffusion: definition, types, importance, and factors affecting diffusion
4.2 Osmosis: definition, types, plasmolysis, deplasmolysis, importance, and factors affecting osmosis
4.3 Transpiration: definition, types, and functions
4.4 Photosynthesis: definition, process importance, and factors affecting photosynthesis.
4.5 Respiration: definition, types, importance, and factor affecting respiration

Unit 5 : Taxonomy and Biodiversity 40 Hrs.

5.1 Plant taxonomy: definition, importance, scope and interrelationship of plant taxonomy
5.2 Classification systems: artificial, natural and phylogenetic with examples and difference
5.3 Biodiversity: concept, types and its importance in agriculture development
5.4 Ecosystems: definition, types (forest and grassland) and protected plant species in Nepal having economic importance
5.5 Viruses: definition, structure, characteristics, economic importance and examples of plant viral diseases
5.6 Bacteria: definition, structure, characteristics, economic importance and role of cyanobacteria in the field of agriculture
5.7 Fungi: definition, characteristic, and economic importance.
5.8 Algae: characteristic of Chlorophyceae, Phaeophyceae, Rhodophyceae and economic importance
5.9 Bryophytes: definition, characteristic, and economic importance
5.10 Pteridophytes: definition, characteristic, life cycle of fern and economic importance of pteridophytes
5.11 Gymnosperms: definition, characteristic, and economic importance
5.12 Angiosperms: definition, characteristic and semi technical description (habitat, general types, parts, features, modification of root, stem, leaf, inflorescence, flower)
5.13 Angiosperm families: characteristics, habitat, examples and economic importance (Brassicaceae and Solanaceae)

Unit 6 : Embryology of Angiosperm 8 Hrs.

6.1 Reproduction: definition, types and importance of vegetative propagation
6.2 Pollination: definition, types and role in crop production
6.3 Fertilization: definition, types, structure of embryo sac and process in angiosperm

Unit 7 : Genetics 6 Hrs.

7.1 Define heredity and variation
7.2 Mendel`s law of inheritance: description of monohybrid and dihybrid crosses
7.3 Role of genetics in crop improvement

Unit 8 : Economic Botany **10 Hrs.**

8.1 Important food plants of Nepal: cereals (rice, maize), vegetables (potato, cauliflower) and fruits (apple, banana)
8.2 Important medicinal plants of Nepal and their uses.
8.3 Ethnobotany: definition, scope and importance

Unit 9 : Biotechnology **8 Hrs.**

9.1 Biotechnology: definition, branches and applications in crop production
9.2 Plant tissue culture: definition, culture media, sterilization, types and applications in modern agriculture
9.3 Plant breeding: introduction, methods, scope and significance in agriculture

Practical **40 Hrs.**

S. N.	List of Taks	Hrs.
1.	Sketch the structure and function of compound microscope, including parts.	4
2.	Perform molecular biology tests: benedict test for reducing sugar, iodine test for starch, biuret test for protein and emulsion test for lipid.	2
3.	Visit two nearby agricultural breeding farms and document breeding techniques.	6
4.	Visit a nearby tissue culture laboratory, observe tissue culture processes and list equipment used.	6
5.	Prepare temporary slides of dicot and monocot stems to study their anatomy.	2
6.	Study diffusion by observing copper sulphate crystals dissolving in a beaker of water.	4
7.	Study osmosis using an egg membrane and relate to plant cell water absorption.	10
8.	Measure the rate of transpiration under varying environmental conditions using Ganong's photometer.	6
9.	Demonstrate oxygen evolution during photosynthesis using aquatic plants under light exposure.	4
10.	Classify bacteria based on shape using stained slides under microscope.	4
11.	Observe Nostoc under a compound microscope.	4
12.	Prepare permanent slides of spirogyra and mucor.	4
13.	Observe the structure and reproduction of a fern using fresh/preserved materials and permanent slides	4
14.	Describe angiosperm families (Cruciferae, Solanaceae) in semi technical terms, including floral characteristics.	4
15.	Study the longitudinal section (L.S.) of an ovule and transverse section (T.S.) of an anther in angiosperms using permanent slides	6
	Total	**70**

Learning References

- Chaudhary, R. P. *Biodiversity in Nepal: Status and conservation*. S. Devi & Tecpress Books.
- Dubey, R. C. *A textbook of biotechnology*. S. Chand & Company Ltd.
- Jain, V. K. *Fundamentals of plant physiology*. S. Chand & Company Ltd.
- Keshari, A. K., Ghimire, K. R., Mishra, B. S., & Adhikari, K. K. *A textbook of higher secondary biology (Class II)*. Vidyarthi Pustak Bhandar.
- Mahat, R. B. *A text book of biology: Part I and Part II*.
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- Ranjitkar, H. D. (2005). *A handbook of practical botany*. Mr. Arun K. Ranjitkar.

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
Unit Hours	4	9	8	12	40	8	6	10	8	**105**
Marks	3	6	6	8	33	6	4	8	6	**80**

Introductory Animal Science

Course Code: AG-108-PS

Year: I **Total: 5 hours /week**

Theory: 3 hours/week

Practical: 2 hours/week

Course Description

This course provides foundational knowledge in animal science, emphasizing the role of livestock in society, the scope, importance, opportunities, and challenges of livestock farming and contemporary issues in Nepal. It covers animal classification, production statistics, good husbandry practices, and farm biosecurity. The course introduces animal welfare principles, ethical concerns, human-animal interactions, and the responsibilities of technicians and owners in preventing cruelty to animals. Additionally, it addresses national legislation governing livestock services to promote sustainable and ethical farming practices.

Objectives

Upon completion of this course, learners will be able to:

- Explain the scope, importance, and objectives of animal science in the context of Nepal.
- Analyse livestock production trends and statistics.
- Apply animal welfare principles, ethical practices, and legal provisions in livestock management.
- Handle and manage animals during farm operations while ensuring their welfare.
- Implement farm biosecurity protocols to prevent disease transmission and ensure a healthy farming environment.

Course Contents

Theory **105 Hrs.**

Unit 1: History, Scope and Challenges of Animal Production Systems **10 Hrs.**

1.1 History, scope, importance of livestock production
1.2 Opportunities and challenges in Nepalese livestock production systems
1.3 Contribution of livestock to agriculture, the national economy, and nutritional security
1.4 Socio-economic role of livestock in livelihoods
1.5 Impact of climate change on livestock production
1.6 Factors influencing livestock production

Unit 2: Terminologies and Classification **5 Hrs.**

2.1 Basic terminologies in animal science
2.2 Taxonomic classification of common farm animals (Cattle, buffalo, sheep, goat, pig, rabbit, poultry and yak)
2.3 Classification of animals based on use (Dairy, meat, egg, draft and companion animals)

Unit 3: Current Statistics of Livestock and their Products **6 Hrs.**

3.1 Overview of Nepal's livestock: population, production trends, and productivity

3.2 Key animal products: milk, meat, eggs, fibre, and hides

Unit 4: Production System of Livestock and Poultry 10 Hrs.

4.1 Extensive farming systems: transhumance, free range, pasture or range grazing (advantages and disadvantages)
4.2 Semi-Intensive livestock farming system (advantages and disadvantages)
4.3 Integrated farming systems (advantages and disadvantages)
4.4 Intensive farming system and other technological advancements (advantages and disadvantages)

Unit 5: Concepts of Animal Welfare 12 Hrs.

5.1 Introduction to animal welfare and its importance in livestock production
5.2 Five freedoms of animal welfare
5.3 Welfare requirements during transportation and slaughter
5.4 Overview of animal welfare initiatives in Nepal
5.5 International frameworks and agreements (WOAH)
5.6 Role of technicians in promoting animal welfare

Unit 6: National Livestock Policies and Legislation 16 Hrs.

6.1 Overview of Livestock-related Policies in Nepal: Preamble, Vision, Mission and Objectives (Use exitance policy, if the following policies are change)
  6.1.1 National Animal Health Policy, 2078
  6.1.2 National Animal Breeding Policy, 2078
  6.1.3 National Dairy Development Policy, 2078
  6.1.4 Prospects of livestock sector in National Periodic Plans
6.2 Key Livestock and Veterinary Acts, Regulations, and Standards: Preamble, Key provisions, and Penalties
  6.2.1 Animal Health and Livestock Services Act, 2055 and its Regulations
  6.2.2 Animal Slaughterhouse and Meat Inspection Act 2055 and its Regulation
  6.2.3 The Council of Animal Health and Livestock Service Professionals Act, 2079
  6.2.4 Feed Act, 2033 and its regulations
  6.2.5 Livestock related provisions in The National Penal (Code) Act, 2074
  6.2.6 Animal Transportation Standard, 2064
  6.2.7 Animal Welfare Directives, 2073
  6.2.8 Legal Provision related to livestock insurance

Unit 7: Ethical Practice for Veterinary Technicians 12 Hrs.

7.1 Code of conduct for veterinary technicians: compassion, competence, integrity.
7.2 Ethical responsibilities towards animals: duty of care and humane treatment
7.3 Ethical responsibilities and professional behaviour towards clients and colleagues
7.4 Ethical decision-making in animal treatment

Unit 8: Basic Animal Handling Practices 10 Hrs.

8.1 Recognizing signs of stress and fear in animals
8.2 Interpreting body language, vocalizations and gestures in different species
8.3 Understanding animal behaviour for safe handling

8.4 Handling and restraining techniques for different species
8.5 Equipment used in animal handling
8.6 Safety protocols for animal handlers

Unit 9: Farm Hygiene and Biosecurity **14 Hrs.**

9.1 Introduction to farm hygiene and biosecurity: roles of technicians and farm level workers, and their importance
9.2 Good Husbandry Practices (GHPs) in livestock farms
9.3 Principles of disinfection and sanitation
9.4 Commonly used disinfectants and their doses
9.5 Farm biosecurity: planning, procedure and common practices

Unit 10: Animal Identification and Record Keeping **10 Hrs.**

10.1 Animal identification methods for different domestic species (e.g. tagging, branding, ear notching, micro-chipping, collars, colouring, etc.)
10.2 Advantages and disadvantages of different identification systems
10.3 Importance of record keeping
10.4 Types of farm records (financial and technical) and their uses

Practical **70 Hrs.**

S.N.	List of Tasks	Hrs.	CA
1	Observe and classify livestock species using visual aids.	9	5
2	Create model of extensive, semi-intensive, and intensive farming systems for comparisons.	4	3
3	Compile and present livestock population and production trends in Nepal using MS Excel.	2	2
4	Observe animal behavior for safe handling and stress management by using audio-visual aids.	3	2
5	Apply safe handling and restraining techniques for dogs and cats.	3	2
6	Apply restraining techniques for cattle and buffaloes (using headlocks, chutes, and ropes)	3	2
7	Apply restraining techniques for sheep and goats (using ropes, holding for medical procedures)	4	3
8	Perform animal identification methods (tagging, branding, ear notching)	4	3
9	9.1 Visit a local government or regulatory authority to study policy and legislation implementation. 9.2 Present the report in group using MS PowerPoint.	12	8
10	Apply common first-aid procedures for livestock.	4	3
11	11.1 Conduct a field visit to livestock markets, transporters, slaughterhouses, farming system to observe animal welfare practices 11.2 Prepare the report in MS Word.	10	8
12	Demonstrate biosecurity measures on farms (disease prevention, footbath procedures, quarantine areas)	4	3

13	Perform farm disinfection and sanitation (fumigation and spray)	4	3
15	Assess Good Husbandry Practices (GHP) on farms (evaluating cleanliness of barns, feed areas, and equipment)	4	3
Total		**70**	**50**

Learning References

- Banerjee, G. C. (2018). *A textbook of animal husbandry*. Oxford and IBH publishing.
- Fraser, D.M., and Fraser, A.F. (2007). *Domestic animal behavior and welfare* (4th ed.). CABI publishers.
- Sastry, N. S. R., Thomas, C. K., and Pearson, R. A. (2005). *Livestock production management*. Kalyani-Publ.
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- Yeates, J. (2012). *Animal welfare in veterinary practice*. John Wiley and Sons.
- Nepal law commission for any animal laws, animal welfare laws of Nepal. (www.nepallawcommission.gov.np)

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	**Pr.**	**Total**
Unit Hour	10	5	6	10	12	16	12	10	14	10		**105**
Marks	6	4	4	6	10	12	8	5	10	5	**10**	**80**

Second year

1. English
2. Applied Animal Breeding
3. Animal Health – II (Parasitology, Surgery, Pharmacology and Non-Infectious disease)
4. Animal Husbandry –I (Ruminant)
5. Animal Husbandry –II (Pig and Poultry)
6. Extension and Communication
7. Animal Product Technology
8. Animal Nutrition – II (Applied Nutrition, Fodder and Pasture)
9. Clinical Practice -I
10. Animal Husbandry Project

English

Course Code: AG-201-SH

Year: II **Total: 4 hours /week**
Lecture: 3 hours/week
Practical: 1 hour/week

Course Description:

This course provides basic techniques for communication in English. It explores the language structure and meaning, guiding learners from general to comprehensive language proficiency. The course emphasizes practical applications, such as writing professional documents and engaging in agricultural discussions, preparing learners for technical roles in agriculture.

Course Objectives:

Upon completion of this course, learners will be able to:

- Construct grammatically correct and coherent sentences.
- Answer comprehension questions based on diverse texts.
- Use appropriate terminology and vocabulary to form meaningful sentences.
- Perform communicative functions in various professional and social contexts.
- Write clear and meaningful paragraphs about people, places and events
- Analyze literary texts to understand themes, contexts and cultural significance.

Course Contents

Theory: 105 Hrs.

Part I: Language Learning 80 Hrs.

Unit 1 : Critical Thinking 4 Hrs.

1.1 Reading Comprehension: Know Thyself (terminology related to thinking skills and question – answer exercises
1.2 Question tags
1.3 Dialogue: Expressing disappointment.
1.4 Writing emails
1.5 Project work

Unit 2 Family 4 Hrs.

2.1 Reading Comprehension: Family (family related terminology, root words and prefixes and question – answer exercises)
2.2 Writing Essays
2.3 Modal Verbs
2.4 Arguing /defending a point
2.5 Project work

Unit 3 : Sports 4 Hrs.

3.1. Reading Comprehension: Euro game (sports related terminology, pronunciation practice and question- answer exercises

3.2. Writing news stories
3.3. Determiners and quantifiers
3.4. Asking for and giving reasons
3.5. Project work

Unit 4 : Education **4 Hrs.**

4.1 Reading Comprehension: A Story of My Childhood (education related terminology and intonation practice and question- answer exercises)
4.2 Writing a biography
4.3 Connectives
4.4 Expressing degrees of Certainty
4.5 Project work

Unit 5 : Humor **4 Hrs.**

5.1 Reading Comprehension: Why do we laugh inappropriately? (synonyms and antonyms of 'laugh', verbs of emotions, and question -answer exercises)
5.2 Writing descriptions of favorite persons
5.3 Adverbs of frequency
5.4 Expressing feelings, emotions, and attitudes
5.5 Project work

Unit 6 : Hobbies **4 Hrs.**

3.1 Reading Comprehension: On Walking (finding meaning in dictionary and question-answer exercises)
3.2 Writing essays
3.3 Passive voice
3.4 Dialogue on reminding
3.5 Project work

Unit 7 : Animal World **4 Hrs.**

7.1 Reading Comprehension: The Medusa and the Snail (finding meaning in dictionary and question-answer exercises)
7.2 Writing Essays
7.2.1 Independence vs. Interdependence.
7.2.2 Increasing individualism in the modern Nepali society.
7.3 Passive Voice
7.4 Expressing counterarguments
7.5 Project work

Unit 8 : History **4 Hrs.**

8.1 Reading Comprehension: After the World Trade Centre (professional terminology and question- answer exercises)
8.2 Description of an event
8.3 Prepositions
8.4 Tenses: simple future, future continuous, future perfect, and future perfect continuous
8.5 Pair work: Speculation
8.6 Project work

Unit 9 : Leisure and Entertainment **4 Hrs.**

9.1 Reading comprehension passage: A Journey Back in Time (content words and question - answer exercises)
9.2 Writing business letters
9.3 Miscellaneous agreements
9.4 Pair work: Expressing indifference
9.5 Project work

Unit 10 : Fantasy **4 Hrs.**

10.1 Reading Comprehension: The Romance of a Busy Broker (Finding meaning in a dictionary, terminologies used in the stock market and question – answer exercises)
10.2 Writing summaries
10.3 Relative clauses
10.4 Describing processes
10.5 Project work

Unit 11 : Technology **4 Hrs.**

11.1 Reading comprehension: Hyper loop (use of technological terms, Use of prefixes and question- answer)
11.2 Issuing a press release
11.3 Subject-Verb agreement
11.4 Summarizing
11.5 Project work

Unit 12 : Money and Economy **4 Hrs.**

12.2 Reading comprehension: QR Code (use of terminologies, abbreviations, vowel sounds and question- answer)
12.3 Writing a news article
12.4 Questions (yes/no questions, wh – (questions and indirect and direct questions)
12.5 Expressing necessity
12.6 Project work

Unit 13 : Human Culture **4 Hrs.**

13.1 Reading comprehension: Land of Plenty (word formation: root, prefixes and prefixes, and question-answer)
13.1 Writing: paragraph and letter to the editor
13.1 Adjectives and Adverbs
13.1 Making comparisons and contrasts
13.1 Project work

Unit 14 : Ecology and Environment **4 Hrs.**

14.1 Reading Comprehension: Living in a Redwood Tree (terminologies used in ecology, compound words and question – answer)
14.2 Writing a book/film review
14.3 Reported speech

14.4 Reporting
14.5 Project work

Unit 15 : Career Opportunities **4 Hrs.**

15.1 Reading Comprehension: Presenting Yourself (employment-related terminologies and answering questions)
15.2 Writing job application with CV
15.3 Conditional Sentences
15.4 Clarifying
15.5 Project Work

Unit 16 : Human Rights **4 Hrs.**

16.1 Reading Comprehension: "I am Sorry"- The Hardest Three Words to Say (word formation and question-answer)
16.2 Writing Paragraphs on Steps on making education equal
16.3 Connectives
16.4 Group work: Criticizing
16.5 Project Work

Unit 17 : War and Peace **4 Hrs.**

17.1 Reading comprehension: Train to Pakistan (terminologies, question -answer and vowels: monophthongs and diphthongs)
17.2 Describing people, places or events
17.3 Past simple, Past continuous, Past perfect, Past perfect continuous tense
17.4 Group work: Making Announcements
17.5 Project Work

Unit 18 : Music and Creation **4 Hrs.**

18.1 Reading Comprehension: A Life of Sound and Silence (terminologies used in music, word Stress, question -answer
18.2 Writing a bibliography.
18.3 Preposition of time
18.4 Group work: Predicting
18.5 Project Work

Unit 19 : Migration and Diaspora **4 Hrs.**

19.1 Reading Comprehension: Dediasporization: Homeland and Hostland (consonants: Voiced and voiceless sounds, stressed an unstressed syllable and question - answer
19.2 Interpreting data in charts and graphs
19.3 Would/ Used to
19.4 Narrating past events
19.5 Project Work

Unit 20 : Power and Politics **4 Hrs.**

20.1 Reading Comprehension: An Open Letter to Mary Daly (terminologies used in politics, consonant cluster and question- answer)

20.2 Writing an article for a newspaper
20.3 Adjective order
20.4 Pair work: denying
20.5 Project work

Section Two: Literature **25 Hrs.**

Unit 1: Short Stories **10 Hrs.**

1. "Neighbors" by Tim Winton
2. "A Respectable Woman" by Kate Chopin
3. "A Devoted Son"by Anita Desai
4. The Treasure in the Forest - H. G. Wells
5. The Half-closed Eyes of the Buddha and the Slowly Sinking Sun -Shankar Lamichhane
6. A Very Old Man with Enormous Wings - Gabriel Garcia Marquez

Unit 2: Poems **6 Hrs.**

1. "A Day" by Emily Dickinson
2. "I Was My Own Route" by Julia de Burgos
3. Soft Storm – Abhi Subedi

Unit 3: Essays **9 Hrs.**

1. "On Libraries" by Oliver Sacks
2. "Marriage as a Social Institution" by Stephen L. Nock
3. Knowledge and Wisdom - Bertrand Russell
4. Humility - Yuval Noah Harari
5. Human Rights and the Age of Inequality - Samuel Moyn

Practical **35 Hrs.**

S.N.	List of Tasks	Hrs.
1	Write a short paragraph describing a daily routine using all three tenses (simple, continuous, perfect). Then, rewrite the paragraph in a different tense, maintaining the same meaning.	3
2	Write sentences using relative clauses (who, whom, which, when, how, where, whose). Create complex sentences where the relative clause adds essential information about the noun.	3
3	Write a list of sentences with various subjects (singular, plural, collective nouns) and ensure the verbs agree with the subjects. Identify and correct any errors in agreement.	3
4	Create sentences using verbs followed by the gerund (-ing form) and infinitive (to + base verb). Provide explanations for why one form is used over the other.	6
5	Write a short biography or a descriptive account of a historical event. Include key facts, dates, and significance.	6
6	Write an essay that describes a place or event in detail. Use sensory details to enhance the reader's experience and create a vivid picture.	4

7	Write and present a narrative essay that tells a story, focusing on character development, plot, and setting. Ensure the story has a clear beginning, middle, and end.	5
8	Write and present a detailed description of a person and a place. focus on using adjectives and precise language to create a clear image.	5
Total		**35**

Learning References

- Panday, R. K. (2050 B.S.). *Yeti tells* (3rd ed.). Sajha Prakashan.
- Lohani, S. P., Adhikari, R. P., & Subedi, A. N. (Eds.). (1996). *Ancient tales*. Educational Enterprises Pvt. Ltd.
- Centre for Curriculum Development. (2077 B.S.). *Grade 12 English*. Government of Nepal.
- Poudel, R. C. (1956/57). *A manual to communicative English*. K.P. Pustak Bhandar.
- Shah, B. L. *A text book of writing skills in English* (1st ed.). Hira Books Enterprises.
- Fruehling, R. T., & Oldham, N. B. (*Write to the point*. McGraw-Hill, Inc.
- Taylor, G. (1975). *English conversation practice*.
- Maharjan, L. B. (2000). *A textbook of English sounds and structures*. Vidyarthi Pustak Bhandar.
- Blundell, J., Higgens, J., & Middlemiss, N. (*Function of English*. Oxford University Press.
- O'Connor, J. D. (*Better English pronunciation* (New ed.). Cambridge University Press.
- Central Department of English, Tribhuvan University. *Link English*

Final written exam marking scheme

Units	Title	Hours	Mark distribution
Part I	**Language Learning**		
1.	Critical thinking	4	6
2.	Family	4	
3.	Sports	4	6
4.	Education	4	
5.	Humor	4	6
6.	Hobbies	4	
7.	Animal World	4	3
8.	History	4	3
9.	Leisure and Entertainment	4	6
10.	Fantasy	4	

11.	Technology	4	6
12.	Money and Economy	4	
13.	Human Culture	4	6
14.	Ecology and Environment	4	
15.	Career Opportunities	4	6
16.	Human Rights	4	
17.	War and Peace	4	
18.	Music and Creation	4	6
19.	Migration and Diaspora	4	6
20.	Power and Politics	4	
	Total	**80**	**60**
Part II		**Literature**	
1.	Short stories	10	8
2.	Poem	6	5
3.	Essay	9	7
	Total	**25**	**20**

Applied Animal breeding

Course Code: AG-202-AS

Year: II **Total: 3 hours /week**
Theory: 2 hours/week
Practical:1 hour/week

Course Description

This course provides foundational knowledge and practical skills in animal breeding and reproductive physiology. It equips learners with competencies in artificial insemination (AI), heat detection, pregnancy diagnosis, and managing reproductive disorders in livestock, tailored to the Nepalese context.

Course Objectives

Upon the completion of this course, the learners will be able to:

- Explain animal breeding system and principles of animal selection.
- Describe reproductive physiology including estrus cycle, fertilization, gestation and parturition.
- Detect animals in heat and perform Artificial Insemination (AI).
- Conduct pregnancy diagnosis using the per rectal method.
- Explain semen collection methods and evaluate semen quality.

Course Contents

Theory **70 Hrs.**

Unit 1: Introduction to Animal Breeding **6 Hrs.**

1.1 Terms and terminology in animal breeding
1.2 History of animal breeding in Nepal
1.3 Importance of breeding management for livestock improvement
1.4 Global trends in animal breeding

Unit 2: Principles of Selection **8 Hrs.**

2.1 Natural and artificial selection
2.2 Basis of selection
2.3 Methods of selection

Unit 3: Livestock Breeding Systems and Strategies **10 Hrs.**

3.1 Random mating systems
3.2 Assortative mating systems
3.3 Inbreeding and outbreeding
3.4 Components of breeding plans for livestock and poultry
3.5 Role of breed conservation and genetic diversity

Unit 4: Reproductive Physiology **10 Hrs.**

4.1 Puberty and sexual maturity
4.2 Factors affecting puberty and sexual maturity

4.3 Spermatogenesis and oogenesis
4.5 Estrus cycle, ovulation, and fertilization
4.6 Gestation and parturition in different livestock species

Unit 5: Heat Detection and Pregnancy Diagnosis 12 Hrs.

5.1 Reproductive behavior and heat detection in cattle, buffalo, sheep, goats, and pigs
5.2 Basics of estrus synchronization
5.3 Advantages and disadvantages of estrus synchronization
5.4 Methods of pregnancy diagnosis (Rectal Palpation, USG and Hormonal)

Unit 6: Semen Collection, Processing, and Artificial Insemination (AI) 14 Hrs.

6.1 Methods of semen collection
6.2 Evaluation of semen quality
6.3 Semen dilution, preservation, transportation, handling, and distribution
6.4 Artificial Insemination (AI) : principles and procedures
6.5 AI techniques
6.6 Advantages and disadvantages of AI
6.7 Factors affecting AI success and conception rates

Unit 7: Common Reproductive Disorders 10 Hrs.

7.1 Common reproductive disorders (anestrus, repeat breeding, genetic disorders, infectious causes and nutritional deficiencies)
7.2 Factors contributing to infertility
7.3 Management of infertility in cattle and buffalo

Practical 35 Hrs.

S. N.	List of Tasks	Hrs.	CAM
1	Develop the wall chart of male and female reproductive systems for different livestock species.	3	2
2	Develop wall chart illustrating ovarian dynamics.	3	2
3	Detect heat in cattle, buffalo, sheep, goats and pigs.	3	2
4	Perform rectal palpation to identify reproductive organs.	3	2
5	Apply AI techniques (vaginal speculum and per rectal methods).	6	4
6	Conduct pregnancy diagnosis using the per rectal method.	5	4
7	Field Visits and Case Studies 7.1 Visit livestock farms to analyze breeding programs. 7.2 Observe and discuss reproductive health management practices. 7.3 Conduct case studies on successful breeding strategies. 7.4 Present a group report using MS PowerPoint.	7	6
8	Evaluate breeding methods and their advantages and limitations (Inbreeding, Cross breeding, out crossing).	3	2
9	Present a video on recent advancement in applied animal biotechnology.	2	1

Total	**35**	**25**

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Pr.**	**Total**
Unit Hours	6	8	10	10	12	14	10	**-**	**70**
Marks	3	4	5	5	6	7	5	**5**	**40**

Animal Health - II

(Parasitology, Surgery, Pharmacology and Non-infectious diseases)

Course Code: AG-203-AS

Year: II **Total: 4 hours /week**

Theory: 3 hours/week

Practical: 1 hour/week

Course Description

This course provides foundational knowledge and practical skills in animal health management, focusing on microbiology, parasitology, pharmacology, general pathology, non-infectious diseases, clinical conditions, and surgical techniques. It includes with competencies to diagnose, treat, and manage non-infectious diseases and conditions affecting livestock and poultry.

Course Objectives

Upon the completion of this course, the learners will be able to:

- Identify and differentiate various disease-causing agents, including bacteria, fungi, viruses, and internal and external parasites.
- Calculate appropriate drug dosages for livestock and poultry.
- Treat and manage various metabolic conditions in livestock and poultry.
- Diagnose, treat and manage non-infectious disease that affect livestock and poultry.
- Examine and manage conditions such as fracture, burns and scalds.

Course Contents

Theory **105 Hrs.**

Unit 1: Microbiology **16 Hrs.**

1.1 Introduction, history, importance and scope of microbiology

1.2 Disease causing agents: Bacteria

1.2.1 General properties of bacteria

1.2.2 Morphology and microscopic structure

1.2.3 Classification of bacteria

1.3 Disease causing agents: Virus

1.3.1 General properties of virus

1.3.2 Classification of virus

1.3.3 Replication of virus

1.4 Disease causing agents: Fungi

1.4.1 General properties of fungi

1.4.2 Classification of fungi

1.4.3 Pathogenic fungi

1.5 Difference between bacteria, fungi and virus

1.6 Immunity and Immunization

1.6.1 Introduction and classification of immunity

1.6.2 Vaccine and Immunization

Unit 2: Parasitology **25 Hrs.**

2.1 Introduction, terminology and classification of parasites affecting livestock and poultry
2.2 Life cycle, treatment and control of trematodes:
  2.2.1 *Fasciola hepatica*
  2.2.2 *Paramphistomum cervi*
  2.2.3 *Schistosoma*
2.3 Life cycle, treatment and control of cestodes:
  2.3.1 *Moniezia*
  2.3.2 *Taenia solium*
  2.3.3 *Taenia saginata*
  2.3.4 *Taenia multiceps* (Gid)
  2.3.5 *Echinococcus granulosus*
2.4 Life cycle, treatment and control of nematodes:
  2.4.1 *Ascaris vitulorum*
  2.4.2 *Ascaridia galli*
  2.4.3 *Hemonchus contortus*
2.5 General characteristics, signs and treatment of external parasites affecting livestock and poultry: Ticks, Mites, Fleas and Lice
2.6 Protozoan parasites:
  2.6.1 *Babesia*
  2.6.2 *Theleiria*
  2.6.3 *Eimeria*

Unit 3: Pharmacology **25 Hrs.**

3.1 Definitions and terminologies
3.2 Importance and scope of veterinary pharmacology
3.2 Route of drug administration
3.3 Indication, routes, dosages, contraindications and side effects of veterinary drugs:
  3.3.1Antibiotics: penicillin, cephalosporins, tetracyclines, gentamicin, fluoroquinolones
  3.3.2Anthelminthic: albendazole, fenbendazole, praziquantel, levamisole, niclosamide, oxyclozanide
  3.3.3 Anti-allergics
  3.3.4 Antipyretics and analgesics (NSAIDs): paracetamol, meloxicam
  3.3.5 Diuretics: furosemides, mannitol
  3.3.6 Local anesthesia: lidocaine
  3.3.7 Miscellaneous drugs (antifungal, antiprotozoal, ectoparasiticide)
3.4 Calculation of dose of drugs
3.5 Factors affecting dose of drugs
3.6 Prescription reading
3.7 Antiseptics and disinfectants
3.8 Antimicrobial resistance (AMR)

Unit 4: General Pathology **12 Hrs.**

4.1 Definitions and terminology in pathology
4.2 Inflammation: classification and cardinal signs

4.3 Inflammatory status of digestive system: stomatitis, gastritis, enteritis
4.4 Dermatitis
4.5 Gangrene
4.6 Cysts, hematoma and abscess

Unit 5: Non-Infectious Diseases Affecting Livestock and Poultry **8 Hrs.**

5.1 Ketosis
5.2 Milk fever
5.3 Grass tetany
5.4 Gout in poultry

Unit 6: Clinical Conditions in Livestock and Poultry **11 Hrs.**

6.1 Tympany
6.2 Metabolic acidosis and alkalosis
6.3 Impaction
6.4 Diarrhea
6.6 Anemia
6.7 Pneumonia
6.8 Mastitis
6.9 Nephritis
6.10 Metritis
6.11 Urolithiosis

Unit 7: Management of Various Conditions of Livestock and Poultry **8 Hrs.**

7.1 Wound healing and management
7.1.1 Basic concept of wound healing
7.1.2 Dressing of wound: wet dressing, dry dressing
7.1.3 Suture of wounds
- Suture materials
- Types of sutures (absorbable and non-absorbable)
- Suture techniques (simple continuous, simple interrupted, mattress)

7.2 Fracture, its types and management of fracture
7.2.1 Basic concept of fracture
7.2.2 Classification of fracture
7.2.3 Basic reduction techniques in fractures
7.2.4 Application of plaster of paris
7.3 Management of burns and scalds
7.3.1 Concept of burns and scalds
7.3.2 Grading of burns
7.3.3 First aid management of burn
7.3.4 First aid management of scald
7.4 Fluid Therapy
7.4.1 Concepts and administration of fluid therapy
7.4.2 Types of fluids and their uses

Practical **35 Hrs.**

S.N.	List of Tasks	Hrs.	CAM
1	1.1 Identify laboratory equipment and their uses. 1.2 Prepare a report on equipment functions and images using MS Word.	4	3
2	Sterilize glassware and laboratory equipment using dry and moist heat methods.	3	2
3	Prepare culture media for microbiological analysis.	4	3
4	Identify parasite eggs of various parasites by fecal examination (direct smear, floatation and sedimentation method)	4	3
5	Examine external parasite using skin scrapping method.	3	2
6	6.1 Calculate dosage of various drugs in different farm animals 6.2 Present fluids used in fluid therapy by MS PowerPoint.	8	6
7	Demonstrate routes of drug administration in farm animals	3	2
8	Perform different suture techniques by using suture materials	4	3
9	Apply plaster of paris on fracture model	2	1
Total		**35**	**25**

Learning References

- Chakraborty, P. (2013). *A textbook of microbiology* (3rd ed.). NCBA.
- Chakrabarti, A. (2023). *Textbook of clinical veterinary medicine* (4th ed.). Kalyani Publications.
- Sandhu, H. S. (2013). *Essentials of veterinary pharmacology and toxicology* (2nd ed.). Kalyani Publications.
- Soulsby, E. J. L. (1982). *Helminths, arthropods and protozoa of domesticated animals* (7th ed.). Blackwell Science Ltd.
- Vegad, J. L. (2019). *A textbook of general veterinary pathology* (2nd ed.). CBS Publishers and Distributors Pvt Ltd.
- Venugopalan, A. (2019). *Essentials of veterinary surgery* (8th ed.). Oxford and IBH Publishing Co Pvt Ltd.

Final Written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	Pr.	Total
Unit Hours	16	25	25	12	8	11	8		**105**
Marks	10	15	15	8	7	8	7	**10**	**80**

Animal Husbandry – I

(Ruminants)

Course Code: AG-204-AS

Year: II **Total: 4 hours /week**
Theory: 2 hours/week
Practical: 2 hours/week

Course Description

This course provides foundational knowledge on the importance, scope and challenges of livestock production with a focus on ruminants. It covers housing, feeding, breeding management and general farm operations for various stages of ruminants including cattle, buffalo, sheep, goats, and yaks. The course includes the physiology of digestion in ruminants, commonly grown fodder trees and their role in livestock feeding as well as common indigenous and exotic breeds found in Nepal. It helps to manage and operate ruminant farms with minimal guidance.

Course Objectives

Upon completion of this course, learners will be able to:

- Explain the scope and importance of ruminants' production and management in Nepal.
- Describe about modern farming systems.
- Identify indigenous and exotic breeds of cattle, buffalo, sheep, goats and yaks.
- Explain feeding, breeding, housing requirement for cattle, buffalo, sheep, goats and yaks.
- Establish and manage a livestock farm with minimal expert guidance.

Course Contents

Theory **70 Hrs.**

Unit 1: Introduction to Ruminants **4 Hrs.**

1.1 Common terminologies in ruminant production
1.2 Differences between ruminants and non-ruminants

Unit 2: Breeds of Cattle, Buffalo, Sheep, Goats and Yaks **9 Hrs.**

2.1 Indigenous breed of cattle, buffalo, sheep, goats and yaks
2.2 Exotic breeds:
2.2.1 Cattle: Jersey, Brown Swiss, Sahiwal, Red Sindhi, Holstein Friesian, Haryana, Gir
2.2.2 Buffalo: Murrah, Jaffarbadi, Niliravi, Surti.
2.2.3 Sheep: Merino, Rambouillet, Corriedale, Polwarth,
2.2.4 Goat: Jamunapari, Boer, Barbari, Saanen, Beetal, Black Bengal

Unit 3: Feeding Management **16 Hrs.**

3.1 Importance of roughages in ruminant production
3.2 Feeding practices for cattle, buffalo, sheep, goat and yak
3.3 Ration formulation and feeding for different age groups
3.4 Total mixed ration (TMR): Definition, uses and preparation

3.5 Fodder calendar for year-round supply of green forage
3.6 Common legume and non-legume forages for large ruminants (management purposes)
3.7 Common legume and non-legume fodder for small ruminants (management purposes)

Unit 4: Breeding and Artificial Insemination **9 Hrs.**

4.1 Definition, uses and recent advancement in animal breeding
4.2 System of breeding
4.3 Methods of selection
4.4 Mechanism of reproduction
4.5 Hormones and their roles in reproduction
4.6 Estrus cycle and heat detection methods
4.7 Artificial insemination (AI): definition, importance and challenges in our context
4.8 Rectal palpation methods for pregnancy diagnosis

Unit 5: Housing Management **7 Hrs.**

5.1 Housing for ruminant species
5.1. Large ruminants
5.1.2 Small ruminants
5.1.3 Yaks
5.2 Housing plan development, including the use of local materials
5.3 Tie stall and loose housing systems
5.4 Space requirement for different age and stage groups of cattle, buffalo, sheep, goats, and yaks.

Unit 6: General Farm Management **6 Hrs.**

6.1 Care and management of pregnant and lactating animals
6.2 Care and management of newborns
6.3 Care and management of heifers
6.4 Care and management of breeding bulls
6.5 Sanitation of dairy barns and equipment's

Unit 7: Healthcare Management **10 Hrs.**

7.1 Common infectious diseases of cattle, buffalo, sheep, goats and yaks (basic management information)
7.2 Common non-infectious diseases of cattle, buffalo, sheep, goats and yaks (basic managemental information)
7.3 Vaccination for disease control
7.4 Farm level biosecurity measures
7.5 Drenching: uses, importance and methods

Unit 8: Economics of Commercial Farming **5 Hrs.**

8.1 Body Condition Scoring (BCS)
8.2 Record keeping in commercial farm (diary, breeding, meat and wool purpose)
8.3 Cost of production for milk and meat

8.4 Economics of dairy farming

Unit 9: Routine Farm Operation **4 Hrs.**

9.1 Identification of farm animals
9.2 De-budding, dehorning, docking
9.3 Castration: importance and methods
9.4 Farm record keeping, body weight calculation for different farm animals, ageing by dentition

Practical **50Hrs.**

S. N	List of Tasks	Hrs.	CAM
1	Identify indigenous breeds: cattle, buffalo, goat and sheep (group presentation).	4	3
2	Identify exotic breeds: cattle, buffalo, goat and sheep (group presentation).	4	3
3	Perform farm animal tagging.	3	2
4	Perform disbudding on newly born calf.	3	2
5	Calculate live body weight using formulas (cattle and goat).	3	2
6	Perform body condition scoring (BCS).	4	2
7	Conduct record keeping of farm animals.	2	2
8	Prepare total mixed ration (TMR) for milking animals.	4	2
9	Perform drenching practices.	3	2
10	10.1 Apply biosecurity measures on a farm. 10.2 Prepare a report on biosecurity measures applied in school livestock farms by using MS Word.	4	3
11	Perform castration techniques.	4	3
12	Demonstrate rectal palpation techniques for pregnancy diagnosis.	2	2
13	Observe artificial insemination and handle semen.	3	2
14	Conduct heat detection and record keeping.	3	2
15	Observe parturition and provide care for newborns.	3	2
16	Prepare housing models for ruminants.	5	4
17	Perform cleaning and sanitation of dairy barns and equipment.	3	2
18	Demonstrate shearing of sheep.	2	2
19	Assess meat quality of meat animals.	2	2
20	Evaluate carcass and calculate dressing percentage.	3	2
21	Perform dehorning.	3	2
22	Conduct dentition and age estimation of farm animals.	3	2
Total		**70**	**50**

Learning References

- Banerjee, G. C. (1964). *A textbook of animal husbandry* (8th ed.). Oxford and IBH Publishing Pvt. Ltd.

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Pr.**	**Total**
Unit Hour	4	9	16	9	7	6	10	5	4		70
Marks	2	4	8	5	3	3	5	3	2	5	40

Animal Husbandry-II

(Non-Ruminant and Companion Animal)

Course Code: AG-205-AS

Year: II **Total: 6 hours /week**

Theory: 3 hours/week

Practical: 3 hours/week

Course description:

This course provides foundational knowledge and practical skills in the management of non-ruminants (pigs, poultry), equines, companion animals (dogs, cats), and apiculture, with an introduction to wildlife management. It covers breeds, housing, feeding, health management, and daily farm operations for commercial and scientific farming in Nepal. The course also addresses common bee races, honey bee management, diseases, and threats, as well as basic wildlife management practices relevant to veterinary technicians.

Course objectives:

Upon completion of this course, learners will be able to:

- Explain scope and importance of non-ruminants, companion animals and wildlife in Nepal.
- Identify breeds of pigs, poultry, dog, cat and equids.
- Design housing for commercial pig and poultry production and hatcheries.
- Perform care and management of pig, poultry and pet animals.
- Explain feeds and feeding of pig, poultry and basic lab animal.
- Conduct daily farm operations on pig and poultry farms.
- Manage the companion animals (dog, cat and equines)
- Perform basic bee-keeping practices.
- Explain general practices in wildlife management.

Course Content

Theory **105 Hrs.**

Unit 1: Poultry Production and Management **25 Hrs.**

1.1 History, current status (statistics), challenges and prospects of poultry production in Nepal
1.2 Common terminologies in poultry farming
1.3 External and internal body parts (digestive and reproductive systems) of chickens
1.4 Indigenous (sakini, ghatikhule, pwakhulte) and exotic (american, english, mediterranean and asiatic) chicken breeds
1.5 Commercial chicken breeds (broiler, layers and dual purpose)
1.6 Housing systems: free range, semi-intensive and intensive
1.7 Site selection, layout plan and poultry shed construction
1.8 Poultry equipment: feeder, drinker, nest box, hover, perches, weighing balance, candler, debeaking machine, vaccinator, refrigerator, light source, and their uses
1.9 Litter management: litter condition, application of lime and bleaching powder
1.10 Types of feeds and feeding practice in broilers and layers

1.11 Record keeping
1.12 Care and management by age: brooding, debeaking, lighting management, culling, molting
1.13 Introduction to duck, japanese quail and kalij pheasant farming

Unit 2: Hatchery Management **5 Hrs**.

2.1 Simple concepts of hatchery design and equipment
2.2 Selection, handling, and storage of eggs for hatching
2.3 Steps in hatching of poultry eggs
2.4 Hatchery egg fumigation and incubation (setting, candling, transfer and hatching)
2.5 Hatchery vaccination
2.6 Chick handling and transportation

Unit 3: Poultry Health Management **5 Hrs**.

3.1 Common diseases and parasites of poultry (detailed in animal health courses)
3.2 Biosecurity measures and their significance in broiler and layer farming
3.3 Common medications: electrolytes, multivitamins, mineral supplements, anthelminthic, probiotics and antibiotics
3.4 Vaccines and vaccination schedules for broiler and layer chicken
3.5 Vaccination methods and precautions

Unit 4: Swine Production and Management **15 Hrs.**

4.1 General characteristics of native (chwanche, hurrah, bampudke, pakhribas black, wild boar) and exotic (yorkshire, hampshire, duroc, tamworth, landrace) breeds of pigs
4.2 Housing systems: free range, semi-intensive, intensive and integrated
4.3 Site selection and construction plans according to minimum standard
4.4 Floor space requirements for farrowing, grow out, holding, finishing and breeding pens
4.5 Care and management by stages: newborn piglets, pregnant sow and breeding boar
4.6 Types of feed and daily feed requirements
4.7 Selection and mating management
4.8 Routine farm operations: identification, body weight estimation, teeth clipping, castration, flushing and record keeping
4.9 Good Husbandry Practices (GHP) in pig farming

Unit 5: Swine Health Management **5 Hrs.**

5.1 General information on major infectious and non-infectious diseases (etiology, transmission, symptoms and diagnosis)
5.2 Control of external and internal parasites
5.3 Biosecurity measures and its importance in pig farming
5.4 Vaccination schedules for pigs

Unit 6: Equine Production and Management **10 Hrs.**

6.1 Introduction, scope and economic importance of equine in Nepal
6.2 Major indigenous and exotic equines breeds
6.3 Housing for equine
6.4 Feeding practices: draft horses, race horse, donkeys and mules
6.5 Estrus cycle, breeding behavior, reproductive behavior in equines
6.6 Care and management by age and physiological stages

6.7 Lameness management and shoeing

Unit: 7 Dog and Cat Management **15 Hrs.**

7.1 Common breeds in Nepal

7.1.1 Dogs: German Shepard, Pug, Japanese Spitz, Labrador, Dalmatian, Golden Retriever, Pitbull, Beagle, Himalayan Mastiff, and Doberman;

7.1.2 Cats: Siamese, Ragdoll, Bombay and Bengal)

7.2 Handling and restraining of dogs and cats

7.3 Care and management: puppies/kittens, adults, geriatric dogs/cats

7.4 Feeding of dogs and cats

7.5 Vaccination and deworming schedules

Unit 8: Apiculture **5 Hrs.**

8.1 Introduction to apiculture

8.2 Common bee races in Nepal

8.3 Seasonal management of honey bees

8.4 Honey bee products and extraction methods

8.5 Disease, insects and other threats to honey bees and their control measures

Unit 9: Wildlife management **20 Hrs.**

9.1 Definition, classification, values of wildlife, and importance in ecosystems and livelihoods

9.2 Distribution of wild mammals, birds, reptiles and amphibians in Nepal; endemic and endangered species

9.3 National parks, wildlife reserves and conservation areas in Nepal

9.4 Wildlife monitoring and population estimation: camera traps, line transects, direct/indirect signs, GPS, telemetry

9.5 Role of veterinary technician in wildlife rescue and rehabilitation

9.6 Human-wildlife conflict: causes, species involved, socio-economic impacts, mitigation and compensation mechanisms

9.7 Common wildlife diseases in Nepal.

Practical **105 Hrs.**

S. N.	List of Tasks	Hrs.	CAM
1.	1.1 Identify common breeds of chicken (Farm visit and online source). 1.2 Conduct a group presentation using MS PowerPoint.	3	3
2	2.1 Identify common breeds of swine (Farm visit and online source). 2.2 Conduct a group presentation using MS PowerPoint.	3	3
3.	Identify common poultry tools and equipment.	2	6
4.	4.1 Draw sketch of external body parts of chicken. 4.2 Present on a wall/flip chart.	2	
5.	5.1 Study external body parts of swine. 5.2 Present on a wall/flip chart.	2	

6.	Perform site selection and design (sketch) layout for a poultry farm.	2	2
7.	Perform site selection and design (sketch) layout for a poultry farm.	4	4
8.	Perform site selection and design (sketch) layout for a poultry farm.	4	4
9.	Perform site selection and design (sketch) layout for a pig farm.	4	4
10.	Perform vaccination in broiler and layer chickens.	4	4
11.	Perform debeaking practices in layers.	3	3
12.	Perform deworming practices in poultry.	3	3
13.	Perform grading and selection of eggs for marketing.	3	3
14.	Perform feeding, watering and litter management in a poultry farm.	4	4
15.	Perform care and management of swine on a farm.	4	3
16.	Prepare daily feed requirement chart for different stages of pigs and poultry.	3	2
17.	Perform postmortem examination of poultry for disease diagnosis.	6	6
18.	Visit a commercial poultry and swine farm and prepare a report visit in MS word.	6	6
19.	Perform biosecurity measure in a poultry farm.	4	10
20.	Prepare farm records for poultry and swine farm.	3	
21.	Manage iron deficiency in piglets.	2	
22.	Perform teeth clipping in piglets.	2	
23.	Perform castration in pigs.	4	3
24.	Identify breeds of dogs and cats.	3	3
25.	Perform vaccination and parasite control in companion animals.	8	8
26.	Perform grooming of dogs and cats.	4	4
27.	Demonstrate honey extraction from a beehive.	5	4
28.	Perform restraining in equines.	2	2
29.	Visit a nearby protected area (day field trip) and prepare a report in MS Word.	6	6
Total		**105**	**100**

Learning references

- Banerjee, G. C. (2000). *A textbook of animal husbandry* (8th ed.). Oxford and IBH Publishing Co. Pvt. Ltd.
- Ghimire, B. (2023). *A textbook of commercial poultry farming*. Heritage Publishers and Distributors Pvt. Ltd.
- Shah, J., Shah, P., & Shah, J. (2021). *Jibachha's textbook of poultry production and management*. Jibachha's Publishing.
- Charles, T. B., & Stuart, H. O. (2011). *Commercial poultry farming*.
- Singh, R. A. (2017). *Poultry production*. Kalyani Publishers.
- Pilliner, S., & Davies, Z. (2013). *Equine science*. John Wiley & Sons.
- Case, L. P., Daristotle, L., Hayek, M. G., & Raasch, M. F. (2010). *Canine and feline nutrition: A resource for companion animal professionals*. Elsevier Health Sciences.
- Akratanakul, P. (1986). *Beekeeping in Asia* (Vol. 4, No. 68). Food and Agriculture Organization.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	Pr.	Total
Unit Hour	25	5	5	15	5	10	15	5	20	-	105
Marks	14	3	3	11	3	8	11	5	12	10	80

Extension and Communication

Course Code: AG-206-PS

Year: II **Total: 3 hours /week**
Theory: 2 hours/week
Practical: 1 hour/week

Course description

This course provides essential knowledge and skills in agricultural extension education and communication. It covers teaching learning processes, extension methods, communication strategies, adoption processes, farmers' training, leadership development, program planning, monitoring, evaluation, pluralism, Gender Equality, Disability and Social Inclusion (GEDSI). The course promotes effective extension programs, fostering sustainable agricultural development in Nepal.

Course Objectives

Upon completion of this course, learners will be able to:

- Explain the importance of extension education and services in agriculture.
- Apply various extension teaching methods to engage farmers.
- Develop program and monitoring plans for extension activities.
- Describe agricultural extension approaches and their basic features.
- Communicate effectively with individuals and groups.
- Develop program and monitoring plans for extension activities.
- Organize and evaluate farmers' training programs.
- Apply concepts of program planning, monitoring, and evaluation in agriculture extension programs

Course Contents

Theory **70 Hrs.**

Unit 1 : Introduction to Extension Education **5 Hrs.**

1.1 Education: meaning, concept, definition, and types
1.2 Extension Education: meaning, concept, origin, and history
1.3 Objectives, scope, and areas of extension education
1.4 Principles of extension education
1.5 Roles and importance of extension education in agricultural development

Unit 2 : Agriculture Extension System in Nepal **8 Hrs.**

2.1 Historical development of agriculture Extension in Nepal
2.2 Organizational set: roles of federal, provincial, and local government
2.3 Extension approaches:
  2.3.1 Training and visit (T&V)
  2.3.2 Integrated Rural Development Project (IRDP)
  2.3.3 Tuki System
  2.3.4 Farming system research and extension (FSRE)

2.3.5 Block Production Program
2.3.6 Farmer Group Approach
2.3.7 Pocket Package Programs
2.3.8 Projectization Approach
2.3.9 Farmer Fields Schools (FFS)
2.3.10 Public-private Partnership (PPP)

2.4 Emerging trends:
2.4.1 Privatization of extension services
2.4.2 Market-led Extension
2.4.3 Farmer-led Extension
2.4.4 E-extension

Unit 3 : **Teaching and Learning Process** **8 Hrs.**

3.1 Meaning and concept of teaching and learning
3.2 Elements and steps of teaching learning process
3.3 Theory of learning, basic principle of adult learning
3.4 Factors affecting adult learning
3.5 Extension teaching methods: individual, group, mass and media mix strategy
3.6 Audio-visual aids: types and uses,
3.7 Use of digital media: mobile application, social media, blogs and vlogs

Unit 4 : Communication Process **5 Hrs.**

4.1 Communication: meaning, concept, elements and models (linear, interactive and transactional)
4.2 Communication channels: types, features and indigenous channels
4.3 Barriers to communication
4.4 ICT in agriculture: uses, types, and functions in Nepalese context

Unit 5 : **Transfer of Technology** **4 Hrs.**

5.1 Concept and models
5.2 Role of extension in transfer of technology

Unit 6 : Diffusion and Adoption of Innovation **6 Hrs.**

6.1 Meaning and concept of innovation, diffusion and adoption
6.2 Adoption process
6.3 Adopter categories and their characteristics
6.4 Factor affecting adoption of innovation in decision making process

Unit 7 : Farmers Training **6 Hrs.**

7.1 Concept and importance of farmers training
7.2 Training needs assessment
7.3 Training cycle: planning, designing, implementation, evaluation
7.4 Evaluation of training programs

Unit 8 : Program Planning, Monitoring, and Evaluation in Extension **8 Hrs.**

8.1 Program, plan, and program planning: meaning, concepts, and importance

8.2 Steps of extension program planning and processes at federal, provincial and local government
8.3 Monitoring and evaluation: concepts, types and importance
8.4 Designing monitoring plans for extension programs

Unit 9 : Leadership Development **4 Hrs.**

9.1 Leadership: meaning, concept and types
9.2 Role and importance in agricultural extension
9.3 Qualities of leaders and selection of local leaders

Unit 10 : Group Formation and Mobilization **6 Hrs.**

10.1 Groups: concept, types and importance
10.2 Group formation procedures
10.3 Group mobilization: activities, resource management
10.4 Conflict management in group

Unit 11 : Gender Equality, Disability and Social Inclusion (GEDSI) in Agriculture Development **4 Hrs.**

11.1 GESI: concepts of gender, social inclusion, equality, equity and gender sensitivity.
11.2 Importance of GEDSI in agricultural development
11.3 Strategies for GEDSI: inclusive policies, targeted training, equitable resource access

Unit 12 : Pluralism in Agriculture Extension **2 Hrs**.

12.1 Pluralism: concept in agriculture extension
12.2 Stakeholders involve in Nepal: government, NGOs, private sector, farmers' groups
12.3 Role and functions of stakeholders
12.4 Coordination for effective service delivery

Unit 13 : Proposal and Report Writing **4 Hrs.**

13.1 Concept, Content and Format

Practical **35 Hrs.**

S.N.	List of Tasks	Hrs.	CAM.
1	Visit a provincial or local agriculture/livestock extension office to observe programs, interact with staff, and learn implementation mechanisms, including group formation processes. Prepare a report on the extension office visit in MS Word and present findings using MS PowerPoint.	9	7
2	Operate audio-visual equipment, LCD/LED projector, and prepare audio-visual aids for extension activities.	2	1
3	Prepare extension literature- leaflets, booklets, folder, pamphlets-news stories	2	1

4	Conduct a training needs assessment for farmers and prepare a training program plan.	6	4
5	Conduct a result demonstration to showcase improved practices.	2	1
6	Conduct a method demonstration to teach specific techniques.	4	3
7	Visit a farmers' group, identify and prioritize their problems/needs, and prepare an extension program plan based on interactions.	4	3
8	Participate in and observe agri-fairs, exhibitions and field days to learn about extension outreach strategies.	3	2
9	Visit extension stakeholders (cooperative/agrovets/groups/NGOs) to learn their roles in extension service delivery.	3	3
Total		**35**	**25**

Learning References

- Dongol, B. B. S. (2004). *Extension education*. Pratima Singh Dongol.
- Dahama, O. P., & Bhatnagar, O. P. (2003). *Education and communication for development*. Oxford & IBH Publishing Co. Pvt. Ltd.
- Sandhu, A. A. (1993). *A textbook of communication process and methods*. Oxford & IBH Publishing Co. Pvt. Ltd.
- Nepal Administrative Staff College. (2019). *Manual on gender equality and social inclusion and gender responsive budgeting: For Class III and Class II officers of GoN*. Nepal Administrative Staff College.
- Rogers, E. M. (2003). *Diffusion of innovation* (5th ed.). Free Press.
- Ray, G. L. (2011). *Extension communication and management*. Kalyani Publishers.
- Directorate of Agriculture Training. (2014). *Training manual on agriculture extension*. Department of Agriculture, Government of Nepal.

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Pr.**	**Total**
Unit Hours	5	8	8	5	4	6	6	8	4	6	4	2	4	**-**	**70**
Marks	2	4	4	2	2	3	3	4	2	3	2	2	2	5	**40**

Animal Product Technology

Course Code: AG-207-AS

Year II **Total: 4 hrs./week**
Theory: 2 hrs./week
Practical: 2 hrs./week

Course Description

This course provides foundational knowledge and practical skills in the dairy, meat, fish, egg and wool industries, focusing on hygienic production, processing, preservation and product diversification. It covers the physio-chemical properties, nutritive value and quality evaluation of milk, meat, eggs, fish and wool as well as wool fiber grading and post shearing operations. It helps to handling, storing, preserving and diversifying animal products for commercial uses.

Course Objectives

Upon completion of this course, learners will be able to:

- Explain the technical aspects of milk and milk products, including preservation and diversification.
- Describe the nutritive value, preservation and diversification of meat, eggs and fish.
- Process milk, meat, egg, fish and wool for human consumption.
- Describe the production and processing of wool.
- Evaluate the quality of milk, meat, eggs, fish and wool.

Course Contents

Theory **70 Hrs.**

Unit 1: Introduction to Animal Product Technology **4 Hrs.**

1.1 Scope, importance and current status of livestock industry in Nepal (dairy, meat, leather, eggs, wool, pashmina)
1.2 Terminologies related to dairy, meat and wool industries
1.3 Requirements and per capita consumption of milk, meat and eggs in Nepal

Unit 2: Basic Dairy Science **6 Hrs.**

2.1. Definition and diagrammatic representation of milk constituents
2.2. Nutritive value of milk
2.3. Physical and chemical properties of milk in brief
2.4. Factors affecting milk composition
2.5. Definition and importance of clean milk
2.6. Sources of milk contamination at dairy farm
2.7. Hand milking and machine milking techniques
2.8. Cleaning and sanitation of dairy barns, equipment and machines
2.9. Flavor defects in milk: causes and prevention
2.10. Sources of contamination in the dairy industry

Unit 3: Processing of Raw Milk **6 Hrs.**

3.1. Receiving, weighing and sampling of milk

3.2. Platform and routine tests for milk quality
3.3. Straining and filtration of milk
3.4. Milk cooling methods and their importance
3.5. Milk pasteurization, homogenization, emulsification: principles and importance
3.6. Heating system of milk
3.7. Toning and standardization of milk
3.8. Milk packaging, distribution and storage at dairy processing units

Unit 4: Diversification of Milk Product **8 Hrs.**

4.1 Importance and nutritive value of milk products
4.2 Flow diagrams for making ghee, butter and yoghurt
4.3 Preparation methods for chhena, paneer, chhurpi, cheese, khoa and ice cream

Unit 5: Meat and its Properties **8 Hrs.**

5.1 Composition of meat
5.2 Nutritive value of meat
5.3 Muscle structure and the conversion of muscle to meat
5.4 Physical and chemical properties of meat

Unit 6: Meat Processing and Preservation **8 Hrs.**

6.1 Slaughtering practices for meat animals
6.2 Types of meat products in brief
6.3 Common meat preservation methods in Nepal: chilling, freezing, curing, smoking, dehydration, canning and radiation
6.4 Meat cutting and packaging for marketing
6.5 Skin and hide processing: curing, soaking, liming, dehairing, deliming, pickling, tanning, drying and finishing

Unit 7: Fish Processing, Quality Evaluation and Preservation **6 Hrs.**

7.1 Nutritive value of fish
7.2 Harvesting fish for human consumption
7.3 Fish processing methods
7.4 Preservation techniques for processed fish

Unit 8: Eggs and their Nutritive Aspects **4 Hrs.**

8.1 Process of egg formation and nutritive value
8.2 Collection, handling, and storage of eggs
8.3 Eggs preservation techniques

Unit 9: Wool Processing **8 Hrs.**

9.1 Shearing techniques
9.2 Wool processing steps: washing, blending, spinning, carding, weaving and finishing
9.3 Properties of true wool
9.4 Factors affecting wool quality
9.5 Grading of wool
9.6 Microscopic examination of wool fiber

Unit 10: Marketing of Animal Products **12 Hrs.**

10.1 Overview of market systems, value chains and marketing of livestock products
10.2 Identifying market demands, trends and value addition techniques for milk, meat, eggs and wool
10.3 Food safety, hygiene and national standards for meat, milk and eggs
10.4 Role of livestock cooperatives, entrepreneurship and public private partnerships in marketing

Practical

70 Hrs.

S. N.	List of Tasks	Hrs.	CAM
1	Identify dairy equipment in the laboratory.	3	2
2	Conduct a survey of common dairy products available in the local market.	3	2
3	Practice hygienic hand milking and milk storage at farm level.	3	2
4	Perform clot on boil (COB) and alcohol test to assess milk heat stability.	3	2
5	Perform methylene blue reduction (MBR) test to assess microbiological quality of milk.	3	2
6	Estimate fat content in milk using Gerber's method.	3	2
7	Estimate acidity in milk by titration method.	3	2
8	Determine SNF, TS, and specific gravity using lactometer.	4	3
9	Perform cream separation: assembling, operation, and recovery estimation.	3	2
10	Perform pasteurization of milk by LTLT method.	3	2
11	Prepare butter, ghee and yoghurt and conduct sensory evaluation.	4	3
12	Prepare chhena and paneer with recovery calculation.	4	3
13	Prepare chhurpi and cheese.	4	3
14	Prepare ice cream and conduct sensory quality evaluation.	5	4
15	Prepare khoa.	3	2
16	Detect common milk adulterants using testing kits.	3	2
17	Visit a slaughterhouse and identify slaughtering tools.	3	2
18	Prepare sausage, meat loaf, and dry meat in laboratory.	3	2
19	Evaluate post-slaughter meat quality and sensory properties.	4	3
20	Visit dairy, meat, fish and wool processing units and observe biosecurity measures.	6	5
	Total	**70**	**50**

Learning References:

- Banerjee, G. C. (2015). *A textbook of animal husbandry* (8th ed.). Oxford and IBH Publishing.
- Chandan, R. C., & Arun, K. (2013). *Manufacturing yoghurt and fermented milk* (2nd ed.). Wiley-Blackwell.
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Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Pr.**	**Total**
Unit Hours	4	6	6	8	8	8	6	4	8	12	-	**70**
Marks	2	3	3	4	4	4	3	2	4	6	5	**40**

Animal Nutrition - II

(Applied Animal Nutrition, Fodder Production and Pasture Management)

Course Code: AG-208-AS

Year: II **Total: 4 hours /week**

Theory: 2 hours/week

Practical: 2 hours/week

Course Description

This course provides foundational knowledge and practical skills in fodder production, pasture management and grassland management, with a focus on agronomical practices for various fodder grasses and trees. It covers forage conservation, alternative feeding resources, agroforestry, silvi-pastoral systems and pasture establishment. The course focuses on the competencies to enhance livestock nutrition through sustainable fodder and pasture management practices.

Objectives

Upon completion of this course learners will be able to:

- Describe the importance of fodder and grasslands in livestock production.
- Identify different types of fodder and forages.
- Apply agronomical practices for fodder production.
- Conserve green forages and explore alternative feeding resources.
- Explain the role of agroforestry and silvi-pastoral systems in livestock nutrition.
- Identify common pasture species and their cultivars and develop skills in pasture establishment and management.

Course Contents

Theory **70 Hrs.**

Unit 1: Fodders and Grassland in Livestock Production 2 Hrs.

1.1 Scope and importance of fodders and grasslands
1.2 Problems and challenges in fodder and grassland management in Nepal

Unit 2: Fodder and Its Classification **2 Hrs.**

2.1 Definitions of forage and fodder
2.2 Annual and perennial fodders
2.3 Leguminous and non-leguminous fodders

Unit 3: Grassland Management **3 Hrs.**

3.1 Introduction to grasslands
3.2 Types of grasslands
3.3 Grassland management techniques

Unit 4: Agronomical Practices for Fodder and Forage Production **25 Hrs.**

4.1 Cultivation practices for leguminous forages
4.2 Cultivation practices for non-leguminous forages
4.3 Cultivation practices for annual forages
4.4 Cultivation practices for perennial forages
4.5 Cultivation practices for fodder trees

4.6 Cultivation practices for cereal crops used as fodder

Unit 5: Conservation of Green Forages **6 Hrs.**

5.1 Introduction, need and scope of forage/fodder conservation
5.2 Hay making: principles and methods
5.3 Silage preparation: principles and methods
5.4 Storage and preservation techniques for conserved forages

Unit 6: Alternative Feeding Resources **8 Hrs.**

6.1 Alternative feeding resources: definition, types, need and importance
6.2 Conventional feeding resources: definition, types, source and nutritive value
6.3 Unconventional/non-conventional feeding resources: definition, type, source, and nutritive value

Unit 7: Agroforestry and Silvi-Pastoral System **8 Hrs.**

7.1 Definition, scope, and importance of agroforestry in livestock production
7.2 Policies and programs of agroforestry in Nepal
7.3 Definition, scope, and importance of silvi-pastoral systems
7.4 Policies and programs of silvi-pastoral system in Nepal: preamble, vision, mission and objectives

Unit 8: Common Pasture Species and Cultivars **8 Hrs.**

8.1 Definition and importance of pasture species for livestock feeding
8.2 Classification of pasture species: grasses, legumes, and shrubs
8.3 Factors influencing species selection: climate, soil, livestock type
8.4 Legume species suitable for pasturelands
8.5 Non-legume, shrubs, and tree species for pastures

Unit 9: Pasture Management **8 Hrs.**

9.1 Status of pasturelands and rangelands in Nepal
9.2 Scope, importance, problems, and challenges of pasture management
9.3 Seeding methods: direct seeding, broadcasting, and drilling
9.4 Soil preparation and fertilization: optimal soil conditions for pasture growth
9.5 Grazing management: rotational grazing and stocking rates
9.6 Pest and disease management: preventative and control measures

Practical **70 Hrs.**

S. N.	List of Tasks	Hrs.	CAM
1	Visit fodder farms: 1.1 Identify best fodder farms and grasslands to visit. 1.2 Observe, review, and analyze best practices. 1.3 Suggest improvements if needed.	6	4
2	Identify fodder crops, grasses, legumes, and tree fodders: 2.1 Identify various fodder crops. 2.2 Identify grasses, legumes, and tree fodders.	5	3
3	Demonstrate proximate analysis of forage grasses and tree fodders (use educational tour or audio-visual methods if not feasible).	6	4
4	Practice agronomical practices for fodder production:	24	20

	4.1 Annual fodder cultivation. 4.2 Perennial fodder cultivation. 4.3 Legume fodder cultivation. 4.4 Non-legume fodder cultivation. 4.5 Cereal crop cultivation for fodder. 4.6 Prepare a report in MS Word and present using MS PowerPoint		
5	Prepare herbarium sheets: 5.1 Introduction to herbarium sheets. 5.2 Collection of plant specimens. 5.3 Press and dry specimens. 5.4 Mount specimens on herbarium sheets. 5.5 Label and document specimens.	5	3
6	Prepare fodder tree saplings, perform plantation and manage: 6.1 Produce fodder tree saplings. 6.2 Apply planting techniques for fodder trees. 6.3 Review and demonstrate management techniques.	14	10
7	Prepare hay.	4	2
8	Prepare silage.	6	4
Total		**70**	**50**

Learning References

- Banerjee, G. C. (2018). *A textbook of animal nutrition*. Oxford and IBH Publishing Co. Pvt. Ltd.
- Ranjhan, S. K. (2001). *Animal nutrition in the tropics*. S. Chand & Company Ltd.

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Pr.**	**Total**
Unit Hour	2	2	3	25	6	8	8	8	8		**70**
Marks	4			12	3	4	4	4	4	**5**	**40**

Clinical Practice-I

Course code: AG-209-AS

Year: II **Total: 3 hours /week**

Course Description

This course provides practical skills in laboratory techniques for disease diagnosis and clinical practices, enabling learners to apply their knowledge confidently in professional veterinary work. It focuses on hands-on training in sample collection, microbiological and parasitological techniques, clinical procedures, and record keeping, tailored to Nepal's veterinary context.

Course Objectives

Upon completion of this course, learners will be able to:

- Perform laboratory techniques for disease diagnosis in animals.
- Apply clinical and laboratory practices effectively in their professional veterinary work.

Course Contents

Practical **105 Hrs.**

S. N.	List of Tasks	Hrs.	CAM
1	Identify common veterinary laboratory equipment.	2	2
2	Demonstrate methods of restraining animals.	6	5
3	Perform body condition scoring (BCS) in livestock.	6	5
4	Identify major anatomical planes on animal models or specimens.	6	5
5	Operate a microscope for diagnostic purposes.	4	4
6	Use antiseptics and disinfectants in clinical settings.	2	2
7	Prepare and clean laboratory glassware.	2	2
8	Perform sterilization techniques.	6	5
9	Perform sample collection, labelling and coding, preservation and dispatch of common animal diseases (whole blood, serum, tissue, swabs).	6	6
10	Prepare blood smears for observation of protozoan parasites.	6	6
11	Prepare microbiological media.	6	5
12	Perform bacterial culture techniques.	6	6
13	Identify bacteria using Gram's staining method.	6	6
14	Perform antibiotic sensitivity test (AST).	4	4
15	Examine milk using the California mastitis test (CMT).	6	6
16	Perform fecal examination techniques: direct smear, Floatation and sedimentation methods.	6	6
17	Conduct skin scraping techniques for external parasite examination.	4	4
18	Perform castration in goats, pigs and calves	6	6
19	Perform caponization in poultry.	4	4
20	Demonstrate routes of drug and vaccine administration (oral, ocular, intramuscular, subcutaneous)	6	6
21	Maintain record keeping and reporting: clinical case records, animal health and treatment registers and field-level technician reporting	5	5

	formats.		
Total		**105**	**100**

Learning References

- Banerjee, G. C. (1964). *A textbook of animal husbandry* (8th ed.). Oxford and IBH Publishing Pvt. Ltd.
- Dhakal, I. P. (n.d.). *Laboratory manual on veterinary microbiology and parasitology*. IAAS, Rampur.
- Sah, N., & Jelen, P. (n.d.). *Laboratory manual of dairy science*. *(Publication year, edition, and publisher are missing—please provide them if known.)*
- Sastry, G. A. (2016). *Veterinary clinical pathology*. CBS Publishers & Distributors Pvt. Ltd.

Animal Husbandry Project

Course Code: AG-210-AS

Year: II **Total : 5 hours /week**

Course description:

This course provides hands-on experience in livestock production and animal husbandry practices, fostering competency in commercial farming through project-based learning. Learners engage in real-world projects to develop skills in management, problem-solving, and innovation, preparing them for entrepreneurship or employment in Nepal's livestock sector. The course emphasizes teamwork, communication, and the application of modern technologies in livestock production.

Course objectives:

Upon completion of this course, learners will be able to:

- Work effectively in workplace-based environment.
- Address and solve real-world problems in livestock production.
- Apply innovative ideas for commercial livestock production, incorporating globalization and digitalization.
- Enhance problem solving, communication, team building and report writing skills.
- Utilize agricultural materials, tools, equipment, machinery and technology.
- Generate creative ideas for value chains, market linkages and marketing channels.
- Develop a professional work culture.

Project

Background

This project-based course runs throughout the academic year, with at least six projects operating concurrently. Projects are handed over to the next batch of students upon completion or when learners progress to the third year, ensuring continuity. This approach provides comprehensive experience from project initiation to completion, building full competency for entrepreneurship or employment. Income generated from project products or services is managed through the school's production unit and distributed per established procedures.

Implementation and operating guidelines

1 **Project selection criteria**

- Comparative advantage of technical school's practical field
- Align with social and local market need
- School available resources
- Interest and competency of instructor

Operating guide lines on the basis of availability of student

Number of learner available in batch	Number of Project run	Remarks
Up to 20	3	
20 to 30	4	

30 to 40	6	

2 **Group division and allocation**

- Form groups of 4-6 learners based on interest and inclusivity
- Assign projects to ensure diverse skill development

3 **Orientation**

Conduct orientation on:

- Project objectives and procedure
- Expected learning outcomes
- Feedback and continuous improvement mechanism
- Mentoring, supervision and continuous assessment
- Resource management, record keeping (physical and financial) and reporting
- Report writing and presentation
- Benefit cost ratio calculation and benefit sharing

(Detail orientation guidelines should developed by school itself)

4 **Forms and formats**

Develop following forms and formats for effective and transparent execution of the project

- Learners' daily attendance on project involvement
- Daily dairy of learners for learning reflection
- Staff involvement and supervision
- Continuous assessment of student progress (knowledge, skills, attitude)
- Production, sales and benefit sharing records
- Report writing and presentation: Write report in word/excel of all projects done by each group and present by using them in each month and final presentation at the end of academic session. Presentation time is the opportunities to other learner to learn skill and problem associated to another project. The guideline of report writing and ppt develop by school itself

Schools develop report and presentation guidelines

5 **Duration**

Each project runs year-round; if not feasible, schools may rotate projects, ensuring six active projects at all times.

6 **Roles and responsibilities**

Instructors: Design, execution and mentor projects
Learners: Actively participate and execute projects
Staff: Support to implement the project
School Management: Supervise and facilitate overall implementation

7 **Assessment and Evaluation**

Assess learners continuously on:

- Knowledge, skills and attitude
- Teamwork, problem solving and leadership
- Conflict management and marketing strategies

Project 1: Commercial Poultry Farm

Objective:

Equip learners with practical skills in poultry farming, focusing on brooding, feeding, health management, and value chain development.

Activities:

- Set up a commercial poultry farm with appropriate housing and biosecurity measures.
- Manage brooding, feeding, vaccination, and medication schedules for broilers or layers.
- Monitor growth, health, and production (eggs or meat).
- Develop marketing strategies for poultry products (e.g., eggs, meat).
- Maintain records of production, sales, and expenses.

Outcome:

Learners gain competency in commercial poultry farming and confidence to establish their own poultry enterprises.

Project 2: Commercial Aquaculture

Objective:

Provide hands-on experience in aquaculture, emphasizing stocking, feed formulation, water management, and value chain development.

Activities:

- Establish a fish farm with suitable ponds or tanks.
- Stock fish species (e.g., carp, tilapia) and monitor water quality parameters.
- Formulate and provide feed, manage feeding schedules, and apply treatments as needed.
- Market fish products and explore value-added options (e.g., smoked fish).
- Record production, health, and financial data.

Outcome: Learners develop skills to establish and manage aquaculture enterprises.

Project 3: Commercial Duck/Quail Farm

Objective:

Train learners in duck/quail farming, covering brooding, feeding, health management, and marketing.

Activities:

- Set up a duck/quail farm with appropriate housing and biosecurity.
- Manage brooding, feeding, vaccination, and medication for ducks or quails.
- Monitor production (eggs or meat) and ensure animal welfare.
- Develop value chains for duck/quail products (e.g., eggs, meat).
- Maintain production and financial records.

Outcome: Learners gain competency in duck/quail farming and entrepreneurial skills.

Project 4: Production and Marketing of Value-Added Dairy Products

Objective:

Provide experience in dairy farming, milk processing, product diversification, and marketing.

Activities:

- Manage a small-scale dairy unit with milking animals (e.g., cows, buffaloes).
- Perform hygienic milking, storage, and processing of milk.
- Produce value-added products (e.g., yoghurt, cheese, ghee, paneer).
- Market dairy products, covering raw material costs through sales.
- Maintain records of milk yield, product sales, and expenses.

Outcome:

Learners develop skills in dairy production, processing, and commercial marketing.

Project 5: Commercial Pig Farming

Objective:

Equip learners with skills in pig farming, including rearing, feed formulation, health management, and marketing.

Activities:

- Establish a pig farm with suitable housing and biosecurity measures.
- Manage pig rearing, including feed formulation and feeding schedules.
- Implement vaccination, medication, and parasite control protocols.
- Market pigs or pork products (e.g., fresh meat, processed products).
- Record production, health, and financial data.

Outcome: Learners gain confidence to start their own piggery enterprises.

Project 6: Sheep/Goat Farming

Objective:

Provide hands-on experience in sheep/goat farming, focusing on management and marketing.

Activities:

- Set up a sheep/goat farm with appropriate housing and grazing areas.
- Manage feeding, health (vaccination, deworming), and breeding programs.
- Monitor production (meat, wool, or milk) and ensure animal welfare.
- Market products (e.g., meat, wool) and explore value chains.
- Maintain production and financial records.

Outcome: Learners develop competency to establish their own sheep/goat farms.

Project 7: Commercial Rabbit Production

Objective:

Train learners in rabbit farming, emphasizing feeding, health management, and marketing.

Activities:

- Establish a rabbit farm with suitable cages and biosecurity.
- Manage feeding, vaccination, and medication schedules.
- Monitor breeding and growth for meat or pet production.

- Market rabbits or rabbit products (e.g., meat, fur).
- Maintain production and sales records.

Outcome: Learners gain skills for commercial rabbit farming enterprises.

Project 8: Meat Processing and Meat Product Marketing

Objective:

Provide experience in meat processing, product diversification, and marketing.

Activities:

- Set up a meat processing unit with hygienic facilities.
- Process meat into products (e.g., sausages, meat loaf, dried meat).
- Ensure quality control and compliance with food safety standards.
- Develop marketing strategies for meat products.
- Record production, sales, and quality data.

Outcome: Learners develop skills in meat processing and commercial marketing.

Project 9: Commercial Production of Forage and Fodder

Objective:

- Equip learners with skills in fodder production, processing, preservation, and marketing.

Activities:

- Cultivate fodder crops (e.g., napier grass, maize) and fodder trees (e.g., leucaena).
- Prepare hay or silage for preservation.
- Package and market fodder products to livestock farmers.
- Monitor crop growth and quality.
- Maintain production and sales records.

Outcome: Learners gain expertise in commercial fodder production and marketing.

Project 10: Pet Animal Production

Objective: Train learners in pet animal breeding, rearing, and marketing.

Activities:

- Establish a pet breeding unit for animals (e.g., dogs, cats).
- Manage breeding, feeding, vaccination, and grooming.
- Ensure pet health and welfare standards.
- Market pets through pet shops or direct sales.
- Maintain breeding and sales records.

Outcome: Learners develop skills to start their own pet shops or breeding businesses.

Project 11: Commercial Nursery for Fodder and Forage

Objective:

Provide experience in producing and marketing fodder/forage seeds, seedlings, and saplings.

Activities:

- Select suitable soil and sites for a nursery.
- Produce seeds, seedlings, and saplings of fodder crops and trees (e.g., alfalfa, mulberry).
- Apply vegetative propagation techniques where applicable.

- Brand and market nursery products to farmers.
- Maintain nursery and sales records.

Outcome: Learners gain competency in nursery management and marketing.

Project 12: Production and Marketing of Animal Feed

Objective:

Equip learners with skills in animal feed formulation, production, and marketing using local ingredients.

Activities:

- Formulate animal feed for specific livestock (e.g., poultry, pigs) using locally available ingredients.
- Produce, package, and ensure quality control of feed products.
- Market feed to local farmers or cooperatives.
- Monitor production costs and sales.
- Maintain production and financial records.

Outcome:

Learners develop expertise in commercial animal feed production and marketing.

Third Year

1 Nepali
2 Animal Health – III (Infectious Diseases and Laboratory Practices)
3 Agricultural Economics, Marketing and Cooperatives
4 Aquaculture and Fisheries
5 Clinical Practice II
6 Entrepreneurship Development
7 Internship Program

नेपाली

Course Code: AG-301-SH

वर्ष: तेस्रो **जम्मा : ३ घण्टा**

सैदधान्तिक : ३ घण्टा

कोर्षको परिचयः

यस पाठ्यक्रममा व्यावसायिक क्षेत्रमा प्रभावकारी ढङ्गले सञ्चार गर्न आवश्यक ज्ञान र सीपहरु समावेश गरिएको छ। यसमा नेपाली भाषा, लेखन तथा संचार र सम्प्रेषण सीप अन्तर्गतका शीर्षकहरु र कृति परिचयको ढाँचासहित जम्मा आठवटा एकाइहरू समावेश गरिएका छन्।

कोर्षको उद्देश्यः

यस पाठ्यक्रमको अध्ययनबाट विद्यार्थीहरूले निम्नलिखित भाषिक क्षमताहरु विकास गर्न सक्नेछनः-

- व्यवसायिक कार्यक्षेत्रमा प्रभावकारी सञ्चार गर्न।
- व्यवसाय सम्बन्धित विविध लेखन सीपहरु प्रदर्शन गर्न।
- कार्य सम्पादनका लागि आवश्यक परिस्थितिजन्य संवाद गर्न।

एकाइ १: नेपाली भाषा र व्याकरण **२५ घण्टा**

१.१ भाषिक भेदको परिचय **५ घण्टा**

- मौखिक र लिखित सञ्चार
- औपचारिक र अनौपचारिक सञ्चार
- अमानक र मानक भाषा
- सामान्य र प्रयोजनमूलक (विशिष्ट) भाषिक भेदहरुको उदाहरणसहित परिचय

१.२ वर्ण परिचय **५ घण्टा**

- नेपाली वर्णहरूको पहिचान
- ध्वनि र वर्ण
- स्वर वर्ण
- व्यञ्जन वर्ण

१.३ वर्णविन्यास

५ घण्टा

- ह्रस्व र दीर्घ स्वरका नियमहरु
- हलन्त र अजन्त प्रयोगका नियमहरु
- शिरबिन्दु र चन्द्रबिन्दुका नियमहरू
- पदयोग र पदवियोगका नियमहरू
- लेख्य चिह्नहरुको परिचय र प्रयोगका नियमहरू

१.४ शब्दभण्डार **४ घण्टा**

- स्रोतका आधारमा शब्दहरुको वर्गीकरण

- बनोटका आधारमा शब्दहरुको वर्गीकरण
- कार्यका आधारमा शब्दहरुको वर्गीकरण

१.५. शब्दरूपायन **३ घण्टा**
- शब्दरूपायनको परिचय
- नामपदको रूपायन
- सर्वनामको रूपायन
- विशेषणको रूपायन
- क्रियापदको रूपायन

१.६ वाक्य संश्लेषण र विश्लेषण **२ घण्टा**
- वाक्य संश्लेषणको परिचय र अभ्यास
- वाक्य विश्लेषणको परिचय र अभ्यास

१.७ पदसङ्गति **१ घण्टा**
- पदसङ्गतिको परिचय
- पदसङ्गतिका प्रकारहरु

एकाइ दुईः लेखन सिप **३० घण्टा**

२.१ बोध लेखन **८ घण्टा**
- बोधको ज्ञान र अभ्यास

२.२ बुँदाटिप्पणी र सारांश लेखन **४ घण्टा**
- बुँदाटिप्पणी लेखन
- सारांश लेखन

२.३ संवाद वा अनुच्छेद लेखन **४ घण्टा**
- संवाद लेखन
- अनुच्छेद लेखन

२.४ व्यावसायिक पत्राचार र सूचना लेखन **५ घण्टा**
- निमन्त्रणापत्र लेखन
- सूचना लेखन
- सम्पादकलाई पत्र लेखन
- निवेदन लेखन
- विज्ञापन लेखन
- बधाईपत्र लेखन

२.५ निबन्ध लेखन **६ घण्टा**
- निबन्ध लेखनको अभ्यास

२.६ प्रतिवेदन लेखन **३ घण्टा**

- प्रतिवेदन लेखनको अभ्यास

एकाइ ३: कृति/पाठ परिचय र कृति समीक्षा **५० घण्टा**

३.१ निम्नलिखित ढाँचामा तलका कृति/पाठको परिचय लेख्ने अभ्यास **१८ घण्टा**

क) कृतिहरू:

- म कसरी हार्छु (नाटक) गोविन्दबहादुर मल्ल गोठाले
- माइतघर (उपन्यास) लैनसिंह बाङ्देल
- राष्ट्रनिर्माता (खण्डकाव्य) माधवप्रसाद घिमिरे

ख) कृति परिचयको ढाँचा

- कृति/पाठको नाम:
- कृति/पाठको रचनाकारको नाम:
- कृति/पाठको मुख्य विषय: (एक अनुच्छेद)
- कृति/पाठको महत्व: (एक अनुच्छेद)
- कृति/पाठले आफूलाई पारेको प्रभाव: (एक अनुच्छेद)
- कृति/पाठको भाषाशैली: (एक अनुच्छेद)
- कृति/पाठको कमी, कमजोरी र सुझाव: (छोटो एक अनुच्छेद)

३.२ कृति समीक्षा **३२ घन्टा**

क) कथाखण्ड **१० घण्टा**

- हरिदत्त: विश्वेश्वरप्रसाद कोइराला
- बितेका कुरा: रुपनारायण सिंह
- मृगतृष्णा: माया ठकुरी

ख) निबन्ध खण्ड **१० घण्टा**

- पहाडी जीवन: लक्ष्मीप्रसाद देवकोटा
- एक पत्र- सम्पादकलाई: शङ्कर लामिछाने
- भान्सा भो हजुर: भैरव अर्याल

ग) कविता खण्ड **६ घण्टा**

- साहित्य सुधा: धरणीधर कोइराला
- हामी: भूपी शेरचन
- नचिनिने भएछौ: अगमसिंह गिरी

घ) एकाङ्की **६ घण्टा**

- भावना: भीमनिधि तिवारी

सिकाइ सामग्रीहरू

- कृष्णप्रसाद पराजुली: राम्रो रचना मीठो नेपाली, सहयोगी प्रेस

- दयाराम श्रेष्ठ र मोहनराज शर्मा: नेपाली साहित्यको सङ्क्षिप्त इतिहास, साझा प्रकाशन
- डा. मोहन बिक्रम थापा: साहित्य परिचय, साझा प्रकाशन
- विश्वेश्वरप्रसाद कोइरालाः दोषी चस्मा कथा सङ्ग्रह, साझा प्रकाशन
- माधवप्रसाद घिमिरेः राष्ट्र निर्माता खण्डकाव्य, साझा प्रकाशन
- लैनसिंह वाङ्देलः माइतघर उपन्यास, रत्न पुस्तक भण्डार
- गोविन्दबहादुर मल्ल गोठालेः भोको घर एकाङ्की सङ्ग्रह, साझा प्रकाशन
- व्यावहारिक नेपाली, टीकाहरि बराल, अस्मिता बुक्स पब्लिसर्स एण्ड डिस्ट्रिब्युटर्स प्रा.लि., पुतलीसडक काठमाडौं

विशिष्टीकरण तालिका

एकाइ	शीर्षक	घण्टा	पूर्णाङ्क
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	१.२ वर्ण परिचय	५	५
	१.३ वर्णविन्यास	५	४
	१.४ शब्द भण्डार	४	३
	१.५ शब्द रुपायन	३	३
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	ख. निवन्ध खण्ड	१०	६

	ग. कविता खण्ड घ. एकाङ्की	६ ६	४ ४
	जम्मा		**८०**

Animal Health III

Course Code: AG-302-AS

Year: III **Total: 4 hours /week**
Theory: 2 hours/week
Practical: 2 hours/week

Course description:
This course provides knowledge and practical skills in diagnosing, treating, and preventing endemic, notifiable, and zoonotic diseases of livestock and poultry in Nepal. It covers common bacterial, viral, fungal, and protozoal diseases, their diagnosis, treatment, and control measures. It equips to perform clinical examinations, laboratory tests, and apply the one health approach, preparing them for veterinary practice in Nepal's context.

Course objectives:
Upon completion of this course, learners will be able to:

- Describe endemic, notifiable and zoonotic diseases of livestock and poultry, along with prevention and control practices in Nepal.
- Diagnose and treat common bacterial diseases of livestock and poultry.
- Diagnose common viral diseases of livestock and poultry.
- Diagnose and treat common fungal and protozoal diseases of livestock and poultry.
- Explain the concept and application of one health approach.
- Perform clinical practices in veterinary setting.
- Collect, preserve, dispatch and analyze samples using basic laboratory tests.

Course Contents

Theory **70 Hrs.**

Unit 1: Common Diseases of Livestock and Poultry in Nepal **5 Hrs.**

1.1. Notifiable diseases in Nepal
  1.1.1. List of notifiable diseases for livestock and poultry
  1.1.2. Disease reporting and epidemiological reporting system
  1.1.3. Provisions for compulsory reporting of notifiable diseases
1.2. Endemic diseases in Nepal
  1.2.1. List of diseases with national control programs
  1.2.2. Overview of National Animal Disease Control Program (FMD, PPR, HS, BQ, CSF, ND, HPAI and Rabies)

Unit 2: Zoonotic Diseases **5 Hrs.**

2.1. Definition and types of zoonosis with examples
2.2. Overview and importance of common zoonotic diseases in Nepal
2.3. Milk borne diseases: causative agents and sources
2.4. Meat borne diseases: causative agents and sources
2.5. Prioritized Zoonotic Diseases (PZDs) in Nepal: brief introduction

Unit 3: Emerging and Re-emerging Diseases **2 Hrs.**

3.1. Concept of emerging and re-emerging disease
3.2. Challenges in controlling emerging and re-emerging diseases

Unit 4: Bacterial Diseases of Livestock **15 Hrs.**

(*Etiology, Route of Transmission, Clinical Signs and Symptoms, Diagnosis, Treatment, Prevention and Control***)**

4.1 Anthrax
4.2 Haemorrhagic Septicaemia
4.3 Black Quarter
4.4 Mastitis
4.5 Tetanus
4.6 Brucellosis
4.7 Enterotoxaemia
4.8 Glanders and Strangles
4.9 Foot Rot
4.10 Bovine Tuberculosis

Unit 5: Bacterial Diseases of Poultry **9 Hrs.**

(Etiology, Route of Transmission, Clinical Signs and Symptoms, Diagnosis, Treatment, Prevention and Control)

5.1 Colibacillosis
5.2 Salmonellosis
5.3 Fowl Typhoid
5.4 Chronic Respiratory Disease (CRD)

Unit 6: Viral Diseases of Livestock **15 Hrs.**

(Etiology, Route of Transmission, Clinical Signs and Symptoms, Diagnosis, Treatment, Prevention and Control)

6.1 Foot and Mouth Disease (FMD)
6.2 Rinderpest
6.3 Peste des Petits Ruminants (PPR)
6.4 Classical Swine Fever (CSF)
6.5 African Swine Fever (ASF)
6.6 Lumpy Skin Disease (LSD)
6.7 Rabies
6.8 Canine Distemper

Unit 7: Viral Diseases of Poultry **10 Hrs.**

(Etiology, Route of Transmission, Clinical Signs and Symptoms, Diagnosis, Treatment, Prevention and Control)

7.1 Avian Influenza (AI)
7.2 Newcastle Disease (ND)
7.3 Infectious Bursal Disease (IBD)
7.4 Marek's Disease
7.5 Infectious Bronchitis

Unit 8: Fungal Diseases of livestock and poultry **4 Hrs.**

(Etiology, Route of Transmission, Clinical Signs and Symptoms, Diagnosis, Treatment, Prevention and Control)

8.1 Ringworm
8.2 Mycotoxicosis
8.3 Aspergillosis

Unit 9: Protozoal Diseases **3 Hrs.**

(Etiology, Route of Transmission, Clinical Signs and Symptoms, Diagnosis, Treatment, Prevention and Control)

9.1 Babesiosis
9.2 Coccidiosis
9.3 Anaplasmosis

Unit 10: One Health **2 Hrs.**

10.1 Concept of one health
10.2 Status and strategies of the one health approach in Nepal

Practical **105 Hrs.**

S. N.	List of Tasks	Hrs.	CAM
1	Identification, disinfection and sterilization: 1.1 Identify common veterinary laboratory equipment. 1.2 Sterilize equipment.	6	6
2	Operate a microscope for diagnostic purposes.	2	2
3	Veterinary drug inventory: 3.1 List commonly available veterinary drugs in the market. 3.2 Prepare and present finding using MS Excel.	10	10
4	Identify healthy and sick animals and poultry.	3	3
5	Restrain animals for clinical examination.	3	3
6	Conduct physical and clinical examinations (temperature, pulse, respiration, rumen motility, palpation, percussion and auscultation) of livestock and poultry.	5	5
7	Fill registration cards and take case histories during consultations.	2	2
8	Collect, label, preserve and dispatch samples for diagnosing livestock and poultry diseases (tissue samples and swabs).	12	12
9	Prepare CMT reagent and examine milk samples.	2	2
10	Prepare bacteriological media.	4	4
11	Perform culture examination of milk samples.	6	6
12	Identify bacteria using Gram's staining method.	4	4
13	Perform Antibiotic Sensitivity Test (AST).	4	4
14	Collect blood from cattle, buffalo, goats, sheep and poultry and separate serum.	4	4
15	Analyze blood samples for CBC and TLC.	4	4
16	Prepare blood smears and identify of common protozoans.	5	4
17	Examine urine samples for identification of ketone bodies	5	4
18	Administer drugs via various routes: oral (drenching), I/M, S/C, I/V, I/P, I/ocular and I/mammary infusion.	4	4
19	Perform post-mortem (PM) examinations on animals and prepare report.	6	5
20	Demonstrate biosecurity practices on a farm.	2	2
21	Visit nearby human health center and prepare a report on zoonotic diseases in MS Word.	4	4
22	One health survey: 22.1 Prepare a questionnaire on one health education/disease epidemiology/disease status. 22.2 Conduct a survey and present findings using MS Excel.	8	6

Total	**105**	**100**

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Pr.**	**Total**
Unit Hours	5	5	2	15	9	15	10	4	3	2		**70**
Marks	10			6	4	6	5	2	2		**5**	**40**

Agricultural Economics, Marketing, and Cooperatives

Course Code: AG-303-PS

Year: III **Total: 4 hours /week**
Theory: 2 hours/week
Practical: 2 hours/week

Course description

This course provides essential knowledge and skills in agricultural economics, farm management, cooperatives and marketing, with a focus on optimizing resource utilization. It covers key areas such as farm planning, budgeting, inventory management, record-keeping, farm efficiency measures, agribusiness operations, cooperative system and marketing strategies, highlighting their importance in modern agriculture. The course prepares learners to works as farm managers, agribusiness professionals or cooperative leaders, enhancing productivity and sustainability in Nepal's agriculture sector.

Course objectives

Upon completion of this course of this course, learners will be able to:

- Explain the concepts and principles of economics, farm management and agricultural marketing.
- Analyze profit maximization conditions under various production relationships.
- Identify market linkages and the role of different market actors.
- Develop effective farm plans, budgets and maintain accurate farm records.
- Assess business risks and apply management strategies in agriculture.
- Calculate farm and market efficiency metrics.
- Identify opportunities for agribusiness innovations on agricultural production and marketing

Course Contents

Theory **70 Hrs**

Unit 1: Overview of Economics **5 Hrs.**

1.1. Definition, scope, types, and importance of economics, behavioral economics and agricultural economics
1.2. Basic Concepts: goods, services, desire, wants, utility, value, price, wealth, production, consumption, equilibrium, and margin
1.3. Supply and demand, price determination, and elasticity
1.4. Challenges and opportunities in Nepalese agriculture: role in food security, trade and rural development.

Unit 2: Factors of Productions and Production Function **5 Hrs.**

2.1 Factors of agricultural production: land, labor, capital and organization (definition, characteristics, trend and issues in Nepal)
2.2 Definition and types of rent, wage, interest and profit
2.3 Production function: definition and three regions of production
2.4 Relationship between total product (TP), marginal product (MP) and average product (AP)

Unit 3: Concepts of Cost and Revenue **3 Hrs.**

3.1 Cost and revenue: definition and types
3.2 Application of cost and revenue concepts in farm management

Unit 4: Introduction to Farm Management **3 Hrs.**

4.1 Farm management: meaning, definition, scope, and characteristics
4.2 Farm resources: land, labor, mechanization and farm layout
4.3 Crop cutting: concept and importance

Unit 5: Principles of Farm Management Decision Making **6 Hrs.**

(Emphasize on the commodities specific examples.)

5.1 Law of diminishing returns (LDR)
5.2 Principle of factor substitution
5.3 Principle of product substitution
5.4 Principle of comparative advantage
5.5 Principle of time comparison
5.6 Opportunity cost principle

Unit 6: Farm Planning and Budgeting **4 Hrs.**

6.1 Farm planning: definition, types and steps
6.2 Farm budgeting: meaning, types (enterprise, partial and whole-farm budgeting) and applications.
6.3 Basic steps in farm budgeting

Unit 7: Farm Business Analysis, Records and Depreciation **8 Hrs.**

7.1 Overview of balance sheet, income statement and cash flow statement
7.2 Farm inventory: definition and process of inventory management
7.3 Depreciation: concept and methods of calculation
7.4 Farm income and profitability: meaning and measurement

Unit 8: Introduction to Agribusiness Management: **4 Hrs.**

8.1 Agribusiness management: definition, nature and components
8.2 Problem and prospects of agribusiness development in Nepal
8.3 Evolving dimensions of Nepal's agribusiness environment.

Unit 9: Risk and Uncertainty **4 Hrs.**

9.1 Risk and uncertainty: concepts, nature and sources in Nepalese agriculture
9.2 Method to mitigate technical, price and financial risks of farm enterprise
9.3 Agricultural insurance, credit and finance: current provisions and prospects in Nepal

Unit 10: Government Intervention in Nepalese Agriculture **2 Hrs.**

10.1 Subsidies: Concept, importance and utilization challenges
20.1 Minimum support price
30.1 Taxation: concept and effect on agriculture

Unit 11: Markets and Their Types **6 Hrs.**

12.1 Definition of market
12.2 Overview of Nepalese agricultural market system: highlights and challenges
12.3 Market information systems: definition and role in agricultural development

Unit 12: Introduction to Agricultural Marketing and Marketing Functions **6 Hrs.**

13.1 Concepts of market, marketing, and agricultural marketing
13.2 Importance of agricultural marketing in Nepal's economic development
13.3 Producer surplus, marketable surplus, marketed surplus and market intermediaries
13.4 Primary functions: assembling, processing, and dispersion

13.5 Secondary functions: standardization, grading, packaging, transportation, storage, financing, risk bearing, and selling

Unit 13: Marketing Channel, Efficiency and Supply Chain 4 Hrs.

13.1 Market integration and marketing efficiency: meaning, definition, types, marketing costs, margin and price spread
13.2 Market promotion: meaning, types and innovative strategies for agricultural market
13.3 Supply chain management: concept, definition and importance
13.4 Value chain analysis: concept, mapping and approaches

Unit 14: Government Intervention in Nepalese Agriculture 2 Hrs.

14.1 Subsidies: Concept, importance and utilization challenges
14.2 Minimum support price
14.3 Taxation: concept and effect on agriculture

Unit 15: Cooperatives 8 Hrs.

15.1 Cooperatives: definition, principle and objectives
15.2 Cooperative marketing and its role in agriculture
15.3 Cooperatives as tools for poverty alleviation and food security in Nepal
15.4 Current issues and challenges in Nepalese cooperative sector

Practical 70 Hrs.

S. N.	List of Tasks	Hrs.	CAM
1	Prepare a report on the economic contribution of agricultural commodities to Nepal's economy using secondary data in MS Word with data processing and tabulation (GDP, trade, food security and employment).	6	4
2	Visit a farm to assess land, labour, wages, rent status, patterns and challenges; prepare and present a group report in MS Word.	4	3
3	Calculate variable costs (VC), fixed costs (FC), total costs (TC), gross revenue, net revenue, and break-even analysis for a farm enterprise.	4	3
4	Estimate the cost of cultivation and farm income measures for two major crops or livestock.	4	3
5	Visit a nearby farm enterprise to identify key problems, propose solution and analyze resource utilization (one student per farm).	4	3
6	Determine the optimum input and output levels and least cost combination of inputs by athematic method.	4	3
7	Determine the profitable combination of products and apply the principle of equi marginal returns.	4	3
8	Prepare and analyze a simple farm plan for a smallholder farm focusing on a single crop or livestock enterprise.	4	3
9	Prepare a whole-farm budget for a diversified farm with multiple enterprises.	6	4

10	Conduct basic farm record-keeping and analysis using manual or digital tools.	2	1
11	Compute depreciation and cost of farm assets using valuation methods.	6	4
12	Conduct a case study on managing risks in monsoon-dependent farming and propose mitigation strategies.	3	2
13	Visit a well-established cooperative to analyze its structure, activities, resource mobilization, and monitoring/evaluation practices; prepare a report.	4	3
14	Visit local markets to observe marketing practices and interact with traders to analyze market functions.	4	3
15	Estimate production and marketing costs of a high-value crop (HVC) at various supply chain levels; calculate price spread, producer's share and market efficiency.	4	3
16	Identify marketing channels for food grains, pulses, oilseeds, fruits, vegetables, flowers, milk and poultry	4	3
17	Map the supply chain of a key crop or livestock commodity.	3	2
Total		**70**	**50**

Learning References:

- Chopra, P.N. (2000). *Principles of economics*. Kalyani Publishers, New Delhi.
- McConnel, C.R. (1975). *Economics: Principles, problems and policies*. McGraw-Hill, USA.
- Johl, S. S., & Kapoor, T. R. (1973). *Fundamentals of farm business management*. Kalyani Publishers, New Delhi.
- Kay, R.D., & Edwards, W. M. (1994). *Farm management*. McGraw Hill, Inc., New Delhi.
- Shankhyan, P. L. (1983). *Introduction to farm management*. Tata, McGraw-Hill, Co. Ltd., New Delhi.
- Acharya, S.S. & Agarwal, N.L. (2011). *Agricultural marketing in India* (5th ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Pandey, M., & Tewari, D. (2010). *The Agribusiness book: Marketing and value chain perspective*. IBDC Publisher, New Delhi.
- Broadway, A.C., & Broadway-Arif, A.A. (2008). *Textbook of agribusiness management*. Kalyani Publisher, New Delhi, India.
- Zimmerrer, T.W. & Scarborough, N.M. (2009). *Essentials of entrepreneurship and small business management.* Pearson Education.

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Pr.**	**Total**
Unit Hours	5	5	3	3	6	4	8	4	4	2	6	6	4	2	8	**-**	**70**
Marks	6			9			8					12				5	**40**

Aquaculture and Fisheries

Course Code**:** AG-304-AS

Year: III **Total: 3 hours /week**

Lecture: 2 hours/week

Practical: 1 hours/week

Course description:

This course provides foundational knowledge and practical skills in an aquaculture and fisheries, focusing on fish biology, desirable characteristics of cultivable species and principles of fish farming. It covers pond construction, water quality management, fish breeding, disease control, and post-harvest practices. It helps to develop competencies in fish culture systems, disease identification, and marketing, tailored to Nepal's aquaculture context.

Course objectives:

Upon completion of this course, learners will be able to:

- Explain the importance of aquaculture in Nepal.
- Compare different fish farming system.
- Describe pond fish farming methodologies.
- Identify common fish diseases in Nepal.
- Perform fish culture practices effectively.

Course Contents:

Theory **70 Hrs.**

Unit 1: Introduction to Fisheries: **8 Hrs.**

1.1. Definition of fish, fisheries (capture and enhanced) and aquaculture
1.2. Capture and enhanced fisheries in Nepal's rivers and lakes
1.3. General characteristics of fish
1.4. Morphology of fish: external features, scales and fins
1.5. Taxonomy of fish species in Nepal
1.6. Desirable characteristics and biology of fish for aquaculture

Unit 2: Fish Culture Systems and Techniques **10 Hrs.**

2.1 Fish farming systems: extensive, semi-intensive, intensive and super intensive
2.2 Cage and pen fish culture in Nepal
2.3 Monoculture vs. Polyculture
2.4 Integrated fish culture
2.5 Raceway culture
2.6 Biofloc and recirculating Aquaculture Systems (RAS)

Unit 3: Pond Construction **8 Hrs.**

3.1. Feasibility and criteria for pond construction
    3.1.1. Water source
    3.1.2. Soil type
    3.1.3. Climate
    3.1.4. Topography
    3.1.5. Social and economic conditions

1.2 Steps for pond construction
    3.2.1 Site selection
    3.2.2 Marking and layout
    3.2.3 Components of ponds and dikes

Unit 4: Water Quality and Pond Management **10 Hrs.**

3.2. Desirable ranges for water quality parameters
- 3.2.1. Temperature
- 3.2.2. Dissolved oxygen
- 3.2.3. pH
- 3.2.4. Plankton levels
- 3.2.5. Turbidity

3.3. Pond management practices
- 3.3.1. Pond liming
- 3.3.2. Pond fertilization
- 3.3.3. Feeding practices
- 3.3.4. Aquatic weed control
- 3.3.5. Predatory fish control

Unit 5: Fish Breeding **12 Hrs.**

5.1 Role of fish seed in aquaculture
5.2 Identification and management of brood fish
5.3 Types of fish breeding: natural, semi-artificial, artificial (induced)
5.4 Hatchery design and its components
5.5 Incubation and hatching processes
5.6 Nursing and rearing of fry
5.7 Transportation of fish seed

Unit 6: Common Fish Diseases **12 Hrs.**

6.1 Factors affecting fish health
6.2 Common fish diseases in Nepal
- 6.2.1 Causes and etiology
- 6.2.2 Symptoms and affected species
- 6.2.3 Types of diseases: infectious and non-infectious

Infectious diseases:
- Protozoan diseases: causal organism, symptoms, control measures
- Worm and crustacean diseases: causal organism, symptoms, control measures
- Fungal diseases: causal organism, symptoms, control measures
- Bacterial diseases: causal organism, symptoms, control measures

Non-infectious diseases: causes and management
- Temperature
- Asphyxiation
- Gas bubble disease
- Mechanical trauma
- Nutritional factors

Unit 7: Harvesting, Marketing and Postharvest Management **10 Hrs.**

7.1 Pre-harvesting management: timing and techniques
7.2 Harvesting tools: nets and others equipment's
7.3 Transportation of live and fresh fish
7.4 Post-harvest practices: drying, smoking, chilling, freezing

Practical **35Hrs.**

S.N.	List of Tasks	Hrs.	CAM
1	Identify cultivated exotic and indigenous fish species.	**1**	**3**
2	Conduct a presentation on the identification of fish species in Nepal (learners' presentation).	**5**	
3	Identify external and internal body parts of fish.	**3**	**8**
4	Visit a fish farm and document the area and types of fish ponds.	**4**	
5	Monitor water quality parameters (morning, midday and evening): water temperature, water pH, dissolved oxygen, turbidity.	**3**	
6	Calculate manure/fertilizer requirements for a fish pond.	**1**	**2**
7	Apply fertilize/ manure to a fish pond.	**1**	
8	Identify aquatic weeds and predatory fish in ponds.	**2**	**1**
9	Identify fish feed ingredients.	**1**	**1**
10	Formulate and prepare fish feed for different feeding methods.	**2**	**1**
11	Identify brood fish (male and female) and breeding equipment.	**2**	**1**
12	Demonstrate natural and artificial fish breeding methods.	**3**	**2**
13	Collect/identify/control common fish parasites.	**2**	**1**
14	Conduct a feasibility study for constructing a new fish pond and prepare a report in MS Word.	**5**	**5**
Total		**35**	**25**

Learning References

- Shrestha, M. K., & Pandit, N. P. (2007). *Principles of aquaculture* (2nd ed.). Department of Aquaculture, Institute of Agriculture and Animal Science.
- Augusty, K. T. (1979). *Fish farming in Nepal*. Archana Printers and Publisher.
- Brown, E. E., & Gratzek, J. B. (1992, June). *Fish farming handbook*. Van Nostrand Reinhold. https://doi.org/10.1002/rrr.3450070212
- Shrestha, T. K., & Jha, D. K. (1993). *Introduction to fish culture*. Institute of Agriculture and Animal Science.
- Woynarovich, E. (1975). *Elementary guide to fish culture in Nepal*. Food and Agriculture Organization of the United Nations.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	Pr.	Total
Unit Hours	8	10	8	10	12	12	10	-	70
Marks	4	5	4	5	6	6	5	5	40

Clinical Practice-II

Course Code: AG-305-AS

Year: III **Total: 2 hours /week**

Course Description

This course provides advanced practical skills in laboratory techniques for disease diagnosis and clinical practices in professional veterinary work. It focuses on hands-on training in clinical examinations, drug administration, post-mortem techniques, artificial insemination, and community-based veterinary services, tailored to Nepal's veterinary context.

Course Objectives

Upon completion of this course, learners will be able to:

- Perform laboratory and clinical techniques for disease diagnosis in animals.
- Apply clinical and laboratory practices effectively in professional veterinary settings.

Course Contents

Practical **70 Hrs.**

S. N.	List of Tasks	Hrs.	CAM
1	Fill registration cards and take case histories during consultations.	2	5
2	Perform physical examinations of animals i.e. temperature, respiration, pulse rate, visible mucus membrane.	6	
3	Measure ruminal motility in cattle and buffalo.	2	2
4	Carry out clinical examinations with emphasis on history taking and techniques i.e. palpation, percussions and auscultation.	8	5
5	Administer drugs and vaccines via various routes: I/D, I/V, I/P and I/mammary infusion.	4	3
6	Provide first aid and wound management (wound cleaning, dressing, and bandaging)	6	4
7	List commonly available veterinary drugs in the market and their uses.	4	3
8	Prepare vaccination schedule for large ruminants, small ruminants, pigs and poultry (broiler and layers).	4	3
9	Perform post mortem (PM) examinations on animals and socument findings.	8	6
10	Detect estrus and perform artificial insemination (AI) in cattle and buffalo.	10	7
11	Organize community based one day animal health camps (minimum two camp).	12	9
12	Prepare and deliver a presentation on a clinical case of livestock.	4	3
Total		**70**	**50**

Learning References

- Sah, N., & Jalen, P. *(n.d.). Laboratory manual of dairy science*. *(Publisher information not provided — include if available).*
- Sastry, G. A. (2016). *Veterinary clinical pathology*. CBS Publishers & Distributors Pvt. Ltd.
- Banerjee, G. C. (1964). *A textbook of animal husbandry* (8th ed.). Oxford & IBH Publishing Co. Pvt. Ltd.

Entrepreneurship Development

Course Code: AG-306-MG

Year: III

Total: 2 hours /week
Theory: 1 hour/week
Practical: 2 hours/week

Course Description

This course equips learners with knowledge and skills to develop business plans and manage small business with a focus on agricultural enterprises. It covers entrepreneurial competencies, business idea identification, and business plan development, explore and apply entrepreneurial skills in real-world settings. The course also helps to manage small businesses or pursue entrepreneurial opportunities in Nepal.

Course Objectives

Upon completion of this course, learners will be able to:

- Describe the concepts of business and entrepreneurship.
- Develop entrepreneurial competencies.
- Analyse business ideas and viability and market potential.
- Formulate comprehensive business plan.
- Manage small businesses effectively.

Course contents

Theory **35 hrs.**

Unit 1: Introduction to Entrepreneurship **8 Hrs.**

1.1 Entrepreneur: definition and roles
1.2 Entrepreneurship: definition and significance in agriculture
1.3 Entrepreneurship development process
1.4 Characteristics of entrepreneurs
1.5 Nature of entrepreneurs
1.6 Human characteristics for entrepreneurship
1.7 Assessing entrepreneurial characteristics
1.8 Comparison of entrepreneurs with other occupations
1.9 Types and styles of entrepreneurs
1.10 Differences between entrepreneur and employees
1.11 Benefit of owning a business
1.12 Understanding “self”: self-awareness and goal setting
1.13 Self-disclosure and feedback: techniques for personal growth
1.14 Entrepreneurial personality tests: concepts and applications

1.15 Assessing entrepreneurial inclination: questionnaires and reflections

Unit 2: Creativity and Assessment **6 Hrs.**

2.1 Concept of creativity
2.2 Barriers to creative thinking
2.3 Concept of innovation
2.4 Concept of transferring idea into action
2.5 Self-assessment of creative style: tools and techniques
2.6 Concept of entrepreneurial competencies
2.7 Assessing personal entrepreneurial competencies
2.8 Decision making: concept and processes
2.9 Personal decision-making attitude
2.10 Dos and don'ts of decision making

Unit 3: Identification and Selection of Potential Business **6 Hrs.**

3.1 Sources of business ideas
3.2 Considerations for selecting business ideas
3.3 Business selection process
3.4 Potential business selection: comparing options
3.5 SWOT analysis of business idea
3.6 Selecting viable business ideas aligned with personal strength and market needs

Unit 4: Business Plan **15 Hrs.**

4.1 Business plan: concept and importance in agriculture
4.2 Production plan: concept, components
4.3 Steps of a production plan: scheduling, resource allocation
4.4 Business operation plan: concept, components
4.5 Steps of a business operation plan: workflow, quality control
4.6 Cost price determination: fixed and variable costs
4.7 Financial plan: concept, components
4.8 Steps of a financial plan: forecasting, funding strategies
4.9 Working capital estimation: calculating operational needs
4.10 Pricing strategy: cost-plus, competitive, value-based pricing
4.11 Profit/loss calculation: income statements, break-even analysis
4.12 Break-even point (BEP) and Return on Investment (ROI): formulas and applications

Practical: **70 Hrs.**

S. N.	List of Tasks	Hrs.	CAM
1	Identify, select potential business ideas and present an overview of two selected business ideas from using MS Power Point.	4	2
2	Analyze the strength, weakness, opportunity and threats (SWOT) of a selected business idea.	8	6

3	Prepare and present business plan for selected idea.	8	6
4	Assess the market for selected business idea.	12	8
5	Prepare marketing strategies for a selected business idea.	8	6
6	Prepare a production plan for a selected business idea.	8	6
7	Prepare a business operation plan for a selected business idea.	8	6
8	Prepare a financial plan for a selected business idea.	8	6
9	Calculate profit and loss for a selected business idea.	6	4
	Total	**70**	**50**

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Internship

Course Code: AG-307-PS

Year: III **Total: 680 hours**
17 weeks
6 months

Course Description

This internship program offers learners with hands-on experience in agriculture-related fields, bridging academic knowledge with practical application. It covers workplace exposure, skill development, farm operations, and research activities. The program enhances problem-solving abilities, introduces learners to real-world job roles, and supports career planning by exploring employment opportunities in the agricultural sector. This course places in final-year Diploma in Agriculture (Animal Science) for a 6-month (680-hour)

Course Objectives

Upon completion of this course, learners will be able to:

- Familarize job roles and work environments in agriculture specially in animal science and related fields.
- Apply academic skills in practical settings, such as farm management and research.
- Acquire new skills not covered in the curriculum, such as advanced technologies.
- Explore job market opportunities and plan career paths accordingly.

Learning Key Areas

General Learning Areas

- Planning, monitoring and evaluating annual programs and budgets in organization.
- Managing daily operations: office management, letter dispatch, record keeping, staff coordination.
- Understanding staff policies: appointment, salaries, benefits (provident fund, gratuities), professional development opportunities.
- Conducting data collection, analysis, report writing and presentations.

Specific Learning Areas

S.N.	Institution/Area	Learning Activities
1	**Farms (Government/ Private)**	1.1 Learn farm management and biosecurity practices 1.2 Maintain records for feeding, breeding and health issues 1.3 Performing routine health care operations 1.4 Monitor farm production
2	**Research Stations**	2.1 Participate in field trials and data collection 2.2 Become familiar with veterinary research methodologies 2.3 Engage in disease diagnosis and test validation research 2.4 Learn data collection, record keeping, data analysis and result evaluation 2.5 Understand types of tests/research conducted 2.6 Explore demonstrated livestock varieties and

		technologies (e.g., improved breeds, feeding systems)
3	**Laboratories (Central/ Provincial/ Research)**	3.1 Use laboratory equipment 3.2 Collect, preserve and dispatch samples 3.3 Handle and prepare samples for analysis 3.4 Understand diagnostic tests and their interpretation 3.5 Perform and interpret tests independently
4	**National Livestock Breeding Office**	4.1 Learn animal breeding principles and techniques 4.2 Performing artificial insemination (AI) in livestock 4.3 Handle and prepare samples for analysis 4.4 Maintain records and conduct pedigree analysis 4.5 Assist in farm management and biosecurity practices
6	**Veterinary Hospital and Clinics (Government/ Private)**	6.1 Take case histories and interact with clients 6.2 Handle clinical cases for small and large animals 6.3 Assist and observe surgical procedures 6.4 Assist with diagnostic imaging (X-ray, ultrasound) and laboratory testing 6.5 Maintain hospital records
7	**Veterinary Hospitals and Livestock Service Expert Centers (VHLSEC)/ Local Level Offices**	7.1 Understand daily livestock service operations 7.2 Respond to farmers' queries 7.3 Conducting clinical examinations and treatments for animals 7.4 Diagnose common diseases and provide first aid 7.5 Conduct farmer trainings 7.6 Learn about livestock extension services 7.7 Understand project selection, implementation, and monitoring

Implementation Plan

S.N.	Activities	Duration	Remarks
1	Orientation	2 days	Before placement: covers objectives, expectations and guidelines
2	Report to the internship site	1 days	Before placement: includes site introduction and onboarding
3	Actual work at the internship site	6 month (680 hours)	Core internship period: supervised practical work
4	Mid-term evaluation	one week	After 10 -12 weeks: conducted by institute or jointly with CTEVT
5	Report to the parental organization	1 days	After placement: debriefing and feedback collection
6	Final report preparation	5 days	After internship: learners compile experiences and outcomes
7	Seminar and final evaluation	3 days	Within 12 days of internship completion: includes presentations and external evaluation

Evaluation

S. N	Evaluator	Marks

1	Supervisor at internship organizations	200
2	Technical Institute (Internal)	200
3	CTEVT or its nominee (external)	100
	Total	**500**

- **Mid-term evaluation:** Conducted after 10-12 weeks by the institute or jointly with CTEVT, focusing on progress and skill development.
- **Final evaluation:** Includes a seminar with report presentations, assessed by the institute, internship supervisor and CTEVT nominee.
- **Rubrics:** Should include criteria for technical skills, professionalism, problem solving and report quality.

Government Organization in the Livestock Sector

Federal

- *Ministry of Agriculture and Livestock Development*
- *Department of Livestock Services*
- *Department of Food Technology and Quality Control*
- *Nepal Agriculture Research Council*
- *Animal Quarantine Division*
- *Animal Disease Investigation and Control Division*
- *Animal Genetic Resources& Economic Analysis Division*
- *Central Veterinary Laboratory (CVL) with five regional veterinary labs in different districts*
- *National Vaccine Production Laboratory (NVL)*
- *Veterinary Standards and Drug Regulatory Laboratory*
- *National Avian Disease Diagnostic Laboratory*
- *FMD & TADs Investigation Laboratory*
- *National Livestock Breeding Centers*
- *Central Referral Veterinary Hospital (CRVH)*

Provincial Level

- *Ministry of Land Management, Agriculture and Cooperatives*
- *Agriculture Development Directorate/training center/hospitals/Farms*
  - Agriculture Business Promotion Support and Training Centre
  - District Agriculture Development Offices (In Some provinces e.g.; Karnali)
  - Livestock Farm Centers
  - Livestock Laboratories-
  - Directorate of Livestock and Fisheries Development
  - Animal Service Training Center
  - Livestock Service Expert Centre and Veterinary Hospital
  - Goat Development Farm
  - Poultry Development Farm
  - Fisheries Development Farm

Local Level

- *Metropolitan city*
- *Sub-metropolitan city*
- *Municipality*
- *Rural municipality*

Acknowledgement

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Experts		
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4	Dr. Balaram Raj Rajbanshi	Bhimsen Thapa Rural Municipality, Gorkha
5	Dr. Bharat Kafle	Ministry of Agriculture and Livestock Development
6	Dr. Bibek Adhikari	Dhading Polytechnic Institute, Dhading
7	Dr. Bikesh Kumar Rawat	Ministry of Agriculture and Livestock Development
8	Dr. Bisheswar Prasad Khanal	Ministry of Agriculture and Livestock Development
9	Dr. Chiranjibi Panth	Ministry of Agriculture and Livestock Development
10	Dr. Dibek Karki	Animal Quarantine Office, Kathamandu
11	Dr. Narayan Neupane	Tribhuvan University, Institute of Agriculture and Animal Science (IAAS)
12	Dr. Narayan Paudel	Nepal Agriculture Research Center (NARC)
13	Dr. Sabina Koirala	Agriculture Information and Training Center
14	Dr. Sandesh Paudel	Madi Municipality, Chitwan
15	Dr. Sikesh Manandhar	Department of Livestock, Ministry of Agriculture and Livestock Development
16	Dr. Sima Sah	Madan Asrit Memorial Polytechnic Institute
17	Dr. Suhel K.C.	Ministry of Agriculture and Livestock Development
18	Dr. Sujan Rana	Nepal Veterinary Council
19	Dr. Sujita Bhuju	Posta Bahadur Bogati Polytechnic Institute
20	Mr. Hikmat Bahadur Khadka	Barpak Sulikot Rural Municipality
21	Mr. Dharma Raj Joshi	Animal Health and Livestock Services Professionals Council

22	Mr. Purna Bahadaur Buda	Animal Health and Livestock Services Professionals Council
23	Mr. Subash Kumar Jha	Central Fisheries Promotion and Conservation Center
24	Mr. Sujit Poudel	Ministry of Agriculture and Livestock Development
25	Mr. Dev Raj Parajuli	Leading Farmer, Kavre
Facilitators		
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2	Deepak Khanal	