CURRICULUM
for
Diploma in Agriculture (Animal Science)

[Intermediate of Science in Agriculture- Major in Animal Science]

(Three-year program-semester system)

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

Development: 2002

First Revision 2014

Second Revision: 2078 (2021)

Contents

Introduction

Agriculture has been handed down traditionally as the major source of livelihood of population in Nepal. With more than 65% of total population involved in agriculture, it is still one of the important sectors of economy. Agriculture covers 27.64% of gross domestic product (GDP). The agricultural practice is integrated with livestock which is mostly subsistent. With milk meat and eggs, our livestock sector is heading towards self-sufficiency while some niche products like yak cheese, pashmina wool, leather, etc. have been established as the prominent products for commercial and export purposes.

The Constitution of Nepal guarantees food and nutritional security to all citizens which requires high priority in agriculture sector. Likewise, agriculture supports employment generation, import substitution, and export promotion which is fundamental to poverty reduction in the country. With the advent of globalization, Nepal's agriculture sector is adapting to technology-based, mechanized, commercial and innovative approaches. The quick development of information, communication and technology has been able to sensitize farmers to new agricultural practices. To meet the envisioned goals and eliminate challenges in this sector, skilled human resource production is important. Especially in the field of livestock like poultry, animal feed, artificial insemination and dairy, highly skilled human resource is required.

CTEVT has been able to produce skilled mid-level frontline human resource in agriculture in Nepal. As the major organization for technical human resource production, CTEVT has a major challenge to meet the demands in the changing context. This is only possible with a comprehensive curriculum that incorporates the contextual and contemporary needs. In this context, CTEVT has introduced a revised curriculum for Diploma in Agriculture (Plant Science) [Intermediate of Science in Agriculture-Major in Animal Science].

Curriculum title

The tittle of this curricular program is Diploma in Agriculture (Plant Science) [Intermediate of Science in Agriculture-Major in Animal Science].

Program Aim

The program aims to prepare mid-level technical human resource equipped with knowledge and skills in agriculture (livestock) and allied subjects.

Program Objectives

This curriculum has following objectives:

1. Diagnose symptoms of different animal diseases and health conditions of livestock species and pets;
2. Provide preventive and curatives services to domesticated animal of farmers and different scales of animal production system;
3. Delver animal management, first aid and referral services;
4. Deliver extension and community development services as a front-line extension worker;
5. Conduct farmers training as a local level resource person for improving animal health, animal feeds, management and caring system;

6. Carryout agribusiness management and cooperatives services at rural and urban areas in public and private sectors;
7. Promote livestock commodities such as milk, eggs, fur, leather and wool production;
8. Communicate effectively and work collaboratively in multidisciplinary and multicultural work environments through recognizing and understanding global, environmental, social, and ethical contexts of their works; and
9. Enable to prepare business plan for establishing small scale production and service related agro-enterprise firms.

Program Description

This course is based on the job required to perform by the Junior Technicians (JT) 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 focusing on Agriculture Animal Science related to the occupation. There are six semesters in total within the period of three years. The first year courses are offered focusing on foundational and core academic subjects of Agriculture Science; the second year courses are focused on basic disciplinary subjects of Agriculture Animal Science. Similarly, the third year whole courses comprise of the disciplinary subjects related to Agriculture Extension, Animal Product, Animal Waste management Poultry and so on. Moreover, the third year insists on the application of learned skills and knowledge through the project work and Internship Program. . The curriculum structure and the subject wise content that reflect the details of this curriculum. In brief, this curriculum will guide to its implementers to produce competent and highly employable middle level technical workforces in the field of Agriculture.

The contents of each subject prescribed in the curriculum are founded on "must know and must do" principle. The contents of the curriculum are comprehensively described in micro-level.

Rationale of Revision

Diploma in Agriculture (Animal Science) [Intermediate of Science in Agriculture-Major in Animal Science] curriculum was developed in 2002. This is the second revision after the implementation of its development. The rationales behind its revision are as follows:

- It crossed the 5 years maturity period of its implementation after its first revision in 2014 and similarly the implementing agencies/college have requested to revise this curriculum based on their teaching experiences.
- The year-wise re-adjustments of the existing subjects are felt necessary.
- It is needed to revisit its weightage in both theory and practical marks contents to make it more practical oriented.
- The technologies invented in this field seems necessary to incorporated.

Furthermore, technicians are projected to grow faster than the average for all occupations. Jobs for Certificate in Agriculture are projected to increase at a faster-than-average rate. To cope with the national and international demands, the knowledge and skills of this curricular program should be updated to make the skills relevant and pertinent to the related Agricultural sector.

Program duration

The total duration of this curricular program is three academic years [six semesters]. The program is based on semester system. Moreover, one semester consists of 19.5 academic weeks including evaluation period. Actual teaching learning Hrs. will be not less than 15 weeks in each semester.

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 target group for this program will be all the interested youths.

Entry Qualification

- SLC or SEE pass with minimum C Grade in any two subjects and D+ in any one subject among Mathematics, Science and English or as per provisions mentioned in the admission guidelines of Office of the Controller of Examinations, CTEVT.
- Pre-diploma in Agriculture (Animal Science) or equivalent with minimum 67.00%.
- Pass entrance examination administered by CTEVT.

Medium of instruction

The medium of instruction will be in English and/or Nepali.

Pattern of attendance

Minimum of 90% attendance in each subject is required to appear in the respective final examination.

Teacher and student ratio
The ratio between teachers and students must be:

- Overall ratio of teacher and student must be 1:10 (at the institution level)
- 1:40 for theory and tutorial classes
- 1:10 for practical classes

Qualification of Instructional Staff

- The program coordinator should be a master's degree holder in the related subject area.
- The disciplinary subject related teachers and demonstrators should be a bachelor’s degree holder in the related subject area.

- The foundational subjects (core and academic courses) related teacher should be master degree holder in the related subject area.

Instructional media and materials
The following instructional media and materials will be used:

- ***Printed media materials:*** Assignment sheets, case studies, handouts, performance checklists, textbooks etc.
- ***Non-project media materials:*** Displays, models, photographs, flipchart, poster, writing board etc.
- ***Projected media materials****:* Slides, overhead transparencies, opaque projections etc.
- ***Audio-visual materials:*** Audiotapes, films, slide-tapes, videodisc, videotapes etc.
- ***Computer based instructional materials:*** Computer based training, interactive video etc.
- **Web-Based Instructional Materials** (Online learning)
- **Radio/Television/Telephone**
- **Education-focused social media platform**

Teaching learning methodologies
This will be a combination of several approaches such as illustrated lecture, group discussion, demonstration, simulation, role play, guided practice, practical work, field visits, laboratory observation and work, report writing, term paper presentation, case analysis, tutoring etc. The main teaching and learning methodology will be as follows:

- Theory: Lecture, Group discussion, assignment and group work etc.
- Practical: Demonstration, observation and self-practice.'
- Internship: Industrial practices

Approach of Learning
There will be inductive, deductive and learner-centered approaches of learning.

Examination and marking scheme

a. Internal assessment

- There will be a transparent/fair evaluation system for each subject in both theory and practical exposure.
- Each subject will have internal assessment at regular intervals and students will get the feedback about it.
- Weightage of theory and practical marks are mentioned in curriculum structure.
- Continuous assessment format will be developed and applied by the evaluators for evaluating student's performance in the subjects related to the practical experience.

b. Final examination

- Weightage of theory and practical marks are mentioned in structure.
- Students must pass in all subjects both in theory and practical for certification. If a student becomes unable to succeed in any subject, she/he will appear in the re-examination administered by CTEVT.
- Students will be allowed to appear in the final examination only after completing the internal assessment requirements.

c. Requirement for final practical examination

- Professional of relevant subject teacher must evaluate final practical examinations.
- One evaluator in one setting can evaluate not more than 20 students.
- Practical examination should be administered in actual situation on relevant subject with the provision of at least one internal evaluator from the concerned constituent or affiliated institute led by external evaluator nominated by CTEVT.
- Provision of re-examination will be as per CTEVT policy.

d. Final practicum evaluation will be based on:

- Institutional practicum attendance - 10%
- Logbook/Practicum book update - 10%
- Spot performance (assigned task/practicum performance/identification/arrangement preparation/measurement) - 40%
- Viva voce:
  - Internal examiner - 20%
  - External examiner - 20%

e. Pass marks:

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

Provision of back paper

There will be the provision of back paper but a student must pass all the subjects of all year within six years from the enrollment date; however, there should be provision of chance exam for final year students as per CTEVT rules.

Disciplinary and ethical requirements

- Intoxication, insubordination or rudeness to peers will result in immediate suspension followed by the review of the disciplinary review committee of the institute.
- Dishonesty in academic or practical activities will result in immediate suspension followed by administrative review, with possible expulsion.
- Illicit drug use, bearing arms in institute, threats or assaults to peers, faculty or staff will result in immediate suspension, followed by administrative review with possible expulsion.

Grading system

The grading system will be as follows:

Grading	**Overall marks**
• Distinction:	80% and above
• First division:	65% to below 80%
• Second division:	50 % to below 65%
• Pass division:	Pass marks to Below 50%

Certificate awarded

- Students who pass all the components of all subjects of all six semesters are considered to have successfully completed the course.
- Students who successfully complete the curricular program will be awarded with a degree of **"Diploma in Agriculture (Animal Science) [Intermediate of Science in Agriculture- Major in Animal Science]".**

Career path

The graduates will be eligible for the position equivalent to Non- gazette 1st class/Level 5 (technical) as prescribed by the Public Service Commission of Nepal and other related agencies.

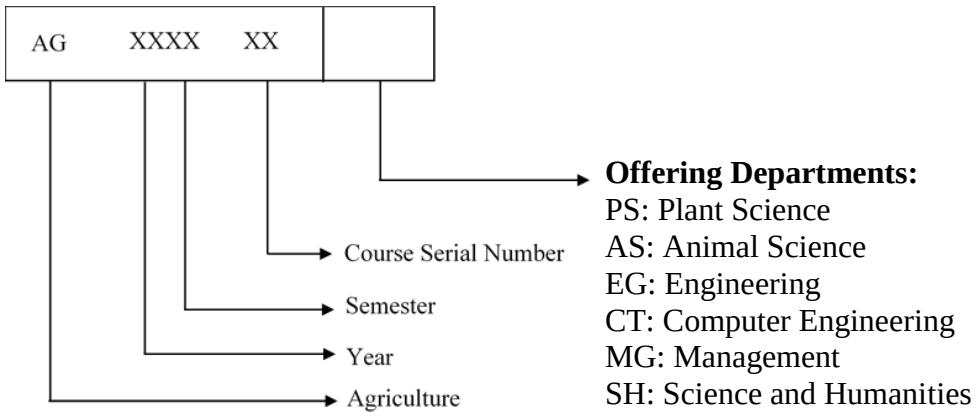
General Attitudes Required

A student should demonstrate following general attitudes for effective and active learning.

Acceptance, Affectionate, Ambitious, Aspiring, Candid, Caring, Change, Cheerful, Considerate, Cooperative, Courageous, Decisive, Determined, Devoted, Embraces, Endurance, Enthusiastic, Expansive, Faith, Flexible, Gloomy, Motivated, Perseverance, Thoughtful, Forgiving, Freedom, Friendly, Focused, Frugal, Generous, Goodwill, Grateful, Hardworking, Honest, Humble, Interested, Involved, Not jealous, Kind, Mature, Open minded, Tolerant, Optimistic, Positive, Practical, Punctual, Realistic, Reliable, Distant, Responsibility, Responsive, Responsible, Self-confident, Self-directed, Self-disciplined, Self-esteem, Self-giving, Self-reliant, Selfless, Sensitive, Serious, Sincere, Social independence, Sympathetic, Accepts others points of view, Thoughtful towards others, Trusting, Unpretentiousness, Unselfish, Willingness and Work-oriented.

Subjects Codes

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



Curriculum Structure

Diploma in Agriculture (Animal Science)

[Intermediate of Science in Agriculture-Major in Animal Science]

Year/ Semester: I/I

S.N.	Code No.	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	Theory			Practical				
			L	T	P	Lab			Assmt. Marks	Final		Assmt. Marks	Final			
										Marks	Time (Hrs.)		Marks	Time (Hrs.)		
1	1101SH	Nepali	4				4	4	20	80	3				100	*continuous assessment
2	1102SH	English I	4				4	4	20	80	3				100	
3	1103SH	Mathematics I	5	1			6	5	20	80	3				100	
4	AG1104SH	Physics I	4	1		2	7	6	20	60	3	10	10	3	100	
5	AG1105SH	Chemistry I	4	1		2	7	6	20	60	3	10	10	3	100	
6	AG1106SH	Zoology I	4			2	6	5	20	60	3	10	10	3	100	
7	AG1107SH	Botany I	4			2	6	5	20	60	3	10	10	3	100	
		Total	**30**	**3**		**8**	**40**	**36**	**140**	**480**		**40**	40		**700**	

Year/ Semester: I/II

S.N.	Code No.	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	Theory			Practical				
			L	T	P	Lab			Assmt. Marks	Final		Assmt. Marks	Final			
										Marks	Time (Hrs.)		Marks	Time (Hrs.)		
1	1201SH	English II	4				4	4	20	80	3				100	
2	1202SH	Mathematics II	5	1			6	5	20	80	3				100	
3	AG1203SH	Physics II	4	1		2	7	6	20	60	3	10	10	3	100	
4	AG1204SH	Chemistry II	4	1		2	7	6	20	60	3	10	10	3	100	
5	AG1205SH	Zoology II	4			2	6	5	20	60	3	10	10	3	100	
6	AG1206SH	Botany II	4			2	6	5	20	60	3	10	10	3	100	
7	EG1211CT	Computer Application	2			2	4	3	10	40	1.5	30	20	3	100	
		Total	**28**	**3**		**10**	**40**	**30**	**130**	**440**		**70**	**60**		**700**	

Diploma in Agriculture (Animal Science)

Year/ Semester: II/I

S.N.	Code No.	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	Theory			Practical				
			L	T	P	Lab			Assmt. Marks	Final		Assmt. Marks	Final			
										Marks	Time (Hrs)		Marks	Time (Hrs)		
1	AG2102AS	Introduction to Animal Production System	3		2/2		4	4	20	80	3	25			125	*continuous assessment
2	AG2103AS	Introductory Animal Nutrition	3		2		5	4	20	80	3	30	20	3	150	
3	AG2104AS	Introduction to Animal Production and Management - I (Cattle, Buffalo, Yak, Sheep and Goat)	4		2		6	5	20	80	3	30	20	3	150	
4	AG2105AS	Basics of Fodder Production and Pasture Management	3		2		5	4	20	80	3	30	20	3	150	
5	AG2106AS	Basic Livestock Health Management - I	5		4		9	7	20	80	3	60	40	4	200	
6	AG2107AS	Basics of Animal Product Technology - I (Dairy and Eggs)	3		2		5	4	20	80	3	30	20	3	150	
7	AG2108AS	Introductory Genetics and Animal Breeding	3		2		5	4	20	80	3	30	20	3	150	
		Total	**24**		**14**		**39**	**32**	**140**	**560**		**235**	**140**		**1075**	

Year/Semester: II/II

S.N.	Code No.	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	Theory			Practical				
			L	T	P	Lab			Assmt. Marks	Final		Assmt. Marks	Final			
										Marks	Time (Hrs)		Marks	Time (Hrs)		
1	AG2201AS	Introduction to Animal Production and Management -II (Horse/Mule, Swine, Rabbit, Pet and Lab Animals)	4		4		8	6	20	80	3	60	40	4	200	*continuous assessment
2	AG2202AS	Basic Livestock Health Management - II	4		4		8	6	20	80	3	60	40	4	200	
3	AG2203AS	Elementary Animal Reproduction	3		2		5	4	20	80	3	30	20	3	150	
4	AG2204AS	Introduction to One Health, Zoonosis and Food Safety	3		2		5	4	20	80	3	30	20	3	150	
5	AG2205AS	Fundamentals of Aquaculture and Fisheries	3		2		5	4	20	80	3	30	20	3	150	
6	AG2206AS	Introductory Agri Economics & Farm Management	4		2		6	5	20	80	3	30	20	3	150	
		Total	**21**		**16**		**37**	**29**	**120**	**480**		**240**	**160**		**1000**	

Diploma in Agriculture (Animal Science)

Year/Semester: III/I

S.N.	Code No.	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	Theory			Practical				
			L	T	P	Lab			Assmt. Marks	Final		Assmt. Marks	Final			
										Marks	Time (Hrs)		Marks	Time (Hrs)		
1	AG3101AS	Introductory Poultry Production & Management	4		2		6	5	20	80	3	30	20	3	150	*continuous assessment
2	AG3102AS	Introductory Veterinary Laboratory Techniques	3		2		5	4	20	80	3	30	20	3	150	
3	AG3103AS	Basics of Animal Product Technology - II (Meat, Fish and Wool)	3		2/2		4	4	20	80	3	25			125	
4	AG3104AS	Fundamentals of Animal Waste Management	3		2/2		4	4	20	80	3	25			125	
5	AG3105AS	Fundamentals of Livestock Extension and Communication	4		2		6	5	20	80	3	30	20	3	150	
6	AG3106AS	Basics of Agribusiness Management, Marketing and Cooperative	2		2/2		3	3	10	40	1.5	25			75	
7	AG3107AS	Introductory Animal Welfare and Jurisprudence	3				3	3	20	80	3				100	
8	AG3108AS	Basics of Farm Housing and Biosecurity.	3		2/2		4	4	20	80	3	25			125	
		Total	**25**		**10**		**35**	**32**	**150**	**600**		**90**	**60**		**1000**	

Year/Semester: III/II

S.N.	Code No.	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	Theory			Practical				
			L	T	P	Lab			Assmt. Marks	Final		Assmt. Marks	Final			
										Marks	Time (Hrs)		Marks	Time (Hrs)		
1	AG3201PS	Elementary Agriculture Statistics	2	1			3	2	10	40	1.5				50	*continuous assessment
2	AG3202PS	Fundamentals of Social Mobilization & Community Development	3		2		5	4	20	80	3	30	20	3	150	
3	EG3201MG	Entrepreneurship Development	3		2		5	4	20	60	3	10	10	2	100	
4	AG3204AS	Internship (Farm Practice Training)	0		26		26	13				200	100		300	
		Total	**8**		**30**		**39**	**23**	**50**	**200**		**260**	**140**		**600**	

First Year/ First Semester

नेपाली

११०१ एस.एच.

वर्षः प्रथम — जम्माः ४ घण्टा/हप्ता

खण्डः प्रथम — प्रवचनः ४ घण्टा/हप्ता

कोर्षको परिचयः

यस विषयमा विद्यार्थीहरूले भावी व्यावसायमा प्रभावकारी ढङ्गले सञ्चार गर्नका लागि आवश्यक पर्ने ज्ञान र सीपसँग सम्बन्धित नेपाली सञ्चारात्मक भाषा, लेखन सीप अन्तर्गतका शीर्षक र कृति परिचयको ढाँचा गरी जम्मा ८ वटा एकाइहरू समावेश गरिएका छन्।

कोर्षको उद्देश्यः

यस पाठ्यांशको अध्ययनबाट विद्यार्थीहरूले निम्न लिखित भाषिक क्षमता विकास गर्न सक्नेछन्ः-

१. आफ्नो व्यावसायिक कार्य क्षेत्रमा प्रभावकारी सञ्चार गर्न
२. आफ्नो व्यावसायसँघ सम्बन्धित विविध लेखन सीप प्रदर्शन गर्न
३. कार्य सम्पादनमा आवश्यक परिस्थितिजन्य संवाद गर्न।

एकाइ १ः संचारात्मक नेपाली भाषा र नेपाली व्याकरण — **१४ घण्टा**

१.१ भाषिक भेदको परिचय — **३ घण्टा**

- मौखिक र लिखित
- औपचारिक र अनौपचारिक
- अमानक र मानक
- सामान्य र प्रयोजनपरक (विशिष्ट) भेदको सोदाहरण परिचय

१.२ वर्णको परिचय — **२ घण्टा**

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

१.३ वर्ण विन्यास — **२ घण्टा**

- ह्रस्व र दीर्घ हुने नियम
- हलन्त र अजन्तको प्रयोग सम्बन्धी नियम
- शिरबिन्दु र चन्द्रबिन्दु सम्बन्धी नियमहरू
- पदयोग र पद वियोग सम्बन्धी नियम
- लेख्य चिह्नहरुको परिचय र प्रयोग सम्बन्धी नियमहरू

१.४ शब्द भण्डार — **३ घण्टा**

- स्रोतका आधारमा शब्दको वर्गीकरण
- बनोटका आधारमा
- कार्यका आधारमा

१.५. शब्द रूपायन — **२ घण्टा**

- रूपायनको परिचय
- नामको रूपायन
- सर्वनामको रूपायन
- विशेषणको रूपायन
- क्रियापदको रूपायन

१.६ वाक्य संश्लेषण र वाक्य विश्लेषण — **१ घण्टा**

- वाक्य संश्लेषण
- वाक्यविश्लेषण

१.७ पदसङ्गति — **१ घण्टा**

- पदसङ्गतिको परिचय
- पदसङ्गतिका प्रकार

एकाइ दुईः लेखन सिप **२२ घण्टा**

२.१ लेखन सिप **६ घण्टा**

- बोधको ज्ञान र अभ्यास

२.२ लेखन सिप **३ घण्टा**

- बुँदाटिपोट
- सारांश लेखन

२.३ लेखन सिप **३ घण्टा**

- संवाद लेखन
- अनुच्छेद लेखन

(कुनै एक)

२.४ लेखन सिप **४ घण्टा**

- निमन्त्रणापत्र
- सूचना
- सम्पादकलाई चिठ्ठी
- निवेदन
- विज्ञापन
- बधाई ज्ञापन

(कुनै एक)

२.५ लेखन सिप **४ घण्टा**

- निबन्ध लेखन

२.६ लेखन सिप **२ घण्टा**

- प्रतिवेदन लेखन

एकाइ ३ः कृति/पाठ परिचय र कृति समीक्षा **२४ घण्टा**

३.१ निम्नलिखित ढाँचामा तलका कृति/पाठको परिचय लेख्ने अभ्यास **६ घण्टा**

क) कृतिहरूः

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

ख) कृति परिचयको ढाँचा

- कृति/पाठको नामः
- कृति/पाठको रचनाकारको नामः
- कृति/पाठको मुख्य विषयः (एक अनुच्छेद)
- कृति/पाठको महत्वः (एक अनुच्छेद)
- कृति/पाठले आफूलाई पारेको प्रभावः (छोटो एक अनुच्छेद)
- कृति/पाठको भाषाशैलीः (छोटो एक अनुच्छेद)
- कृति/पाठको कमी, कमजोरी र सुझावः (छोटो एक अनुच्छेद)

३.२ कृति समीक्षा **१८ घन्टा**

क) कथाखण्ड **५ घण्टा**

- हरिदत्तः विश्वेश्वरप्रसाद कोइराला
- बितेका कुराः रुपनारायण सिंह
- मृगतृष्णाः माया ठकुरी

ख) निबन्ध खण्ड **५ घण्टा**

- पहाडी जीवनः लक्ष्मीप्रसाद देवकोटा

- एक पत्र— सम्पादकलाईः शङ्कर लामिछाने
- भान्सा भो हजुरः भैरव अर्याल

ग) कविता खण्ड **४ घण्टा**

- साहित्य सुधाः धरणीधर कोइराला
- हामीः भूपी शेरचन
- नचिनिने भएछौः अगमसिंह गिरी

घ) एकाङ्की **४ घण्टा**

- भावनाः भीमनिधि तिवारी

सिकाइ सामग्रीहरू

- कृष्णप्रसाद पराजुलीः राम्रो रचना मीठो नेपाली, सहयोगी प्रेस
- दयाराम श्रेष्ठ र मोहनराज शर्माः नेपाली साहित्यको सङ्क्षिप्त इतिहास, साझा प्रकाशन
- डा. मोहन बिक्रम थापाः 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
- गोरखापत्र, कान्तिपुर आदि पत्रिका सम्पादकीय, टिप्पणी र लेखहरू
- प्रशिक्षकहरूले आफ्नो पुस्तक तयार गर्न वा बजारमा पाइने सामग्री छानेर पढाउन सक्ने

विशिष्टीकरण तालिका

एकाइ	शीर्षक	समय	पूर्णांक
१	**संचारात्मक नेपाली भाषा र नेपाली व्याकरण**	**१४ घण्टा**	**पूर्णाङ्क (२४)**
	१.१ भाषिक भेदको परिचय	३ घण्टा	पूर्णाङ्क (४)
	१.२ वर्णको परिचय	१ घण्टा	पूर्णाङ्क (२)
	१.३ वर्णविन्यास	३ घण्टा	पूर्णाङ्क (४)
	१.४ शब्द भण्डार	३ घण्टा	पूर्णाङ्क (२)
	१.५ शब्द रुपायन	२ घण्टा	पूर्णाङ्क (४)
	१.६ वाक्य संश्लेषण र वाक्य विश्लेषण	१ घण्टा	पूर्णाङ्क (४)
	१.७ पदसङ्गति	१ घण्टा	पूर्णाङ्क (४)
२	**लेखन सीप**	**२२ घण्टा**	**पूर्णाङ्क (३२)**
	२.१ लेखन सीप (बोधको ज्ञान)	६ घण्टा	पूर्णाङ्क (८)
	२.२ लेखन सीप (बुँदा लेखन, सारांश लेखन)	३ घण्टा	पूर्णाङ्क (४)
	२.३ लेखन सीप (संवाद लेखन, अनुच्छेद लेखन)	३ घण्टा	पूर्णाङ्क (४)
	२.४ लेखन सीप (निमन्त्रणा पत्र, सूचना, सम्पादकलाई चिठ्ठी, निवेदन, विज्ञापन, बधाई ज्ञापन)	४ घण्टा	पूर्णाङ्क (४)
	२.५ लेखन सीप (निबन्ध लेखन)	४ घण्टा	पूर्णाङ्क (८)
	२.६ लेखन सीप (प्रतिवेदन लेखन)	२ घण्टा	पूर्णाङ्क (४)
३	**कृति/पाठको परिचय लेख्ने अभ्यास**	**२४ घण्टा**	**पूर्णाङ्क (२४)**
	३.१ कृति/पाठको परिचय लेख्ने अभ्यास	६ घण्टा	पूर्णाङ्क (८)
	३.२ कृति समीक्षा	१८ घण्टा	पूर्णाङ्क (१६)
	क. कथा खण्ड	५ घण्टा	पूर्णाङ्क (४)
	ख. निवन्ध खण्ड	५ घण्टा	पूर्णाङ्क (४)
	ग. कविता खण्ड	४ घण्टा	पूर्णाङ्क (४)
	घ. एकाङ्की	४ घण्टा	पूर्णाङ्क (४)

English I

1102 SH

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

Semester: I **Lecture: 4 hour/week**

Practical: hours/week

Course Description:

This course is designed with a view to provide students techniques in using English for academic and communicative purposes, train them in the comprehending varieties of texts, terminologies, grammatical and communicative areas of English language, make them see the relationship between structure and meaning. This guides the students from general to comprehensive understanding of language.

Course Objectives:

On completion of the course the students will be enabled to:

1. Construct sensible sentences applying the grammatical structures.
2. Answer the questions given after the comprehension passage.
3. Use terminologies vocabularies to construct sensible sentences.
4. Perform the communicative functions in given situation.
5. Write paragraphs on people, place and events correctly and meaningfully.
6. Analyze the literary texts.

Section One: Language Development **40 Hrs.**

Unit 1: Critical thinking **4 Hrs.**

1.1 Reading Comprehension: Know Thyself
- 1.1.1 Terminologies of thinking skills
- 1.1.2 Question – answer

1.2 Writing Email
1.3 Question Tag
1.4 Dialogue: Expressing disappointment.
1.5 Project Work

Unit 2: Family **4 Hrs.**

2.1 Reading Comprehension: Family
- 2.1.1 Family related terminologies.
- 2.1.2 Root words and prefixes
- 2.1.3 Question - answer

2.2 Writing Essay
2.3 Modal Verbs
2.4 Arguing /defending a point
2.5 Project Work

Unit 3: Sports **4 Hrs.**

3.1. Reading Comprehension: Euro 2020
- 3.1.1 Use of sports related terminologies
- 3.1.2 Pronunciation
- 3.1.3 Question- answer

3.2. Writing a news story
3.3. Determiner and Quantifier

3.4. Asking for and giving reason
3.5. Project Work

Unit 4: Education **4 Hrs.**

4.1 Reading Comprehension: A Story of My Childhood
  4.1.1 Use of terminologies of Education.
  4.1.2 Intonation
  4.1.3 Question- answer
4.2 Writing a biography
4.3 Connectives
4.4 Expressing the degrees of Certainty
4.5 Project Work

Unit 5: Humor **4 Hrs.**

5.1 Reading Comprehension: Why do we laugh inappropriately?
  5.1.1 Synonyms and antonyms of verb: 'laugh'
  5.1.2 Verbs of emotions
  5.1.3 Question -answer
5.2 Describing a favorite person
5.3 Adverbs of Frequency
5.4 Expressing feelings, emotions and attitudes
5.5 Project Work

Unit 6: Hobbies **4 Hrs.**

6.1 Reading Comprehension: On Walking
  6.1.1 Finding meaning in dictionary
  6.1.2 Question- answer
6.2 Writing an essay
6.3 Passive voice
6.4 Dialogue on Reminding
6.5 Project Work

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

7.1 Reading Comprehension: The Medusa and the Snail
  7.1.1 Finding meaning in dictionary
  7.1.2 Question-answer
7.2 Writing Essay
  7.2.1 Independence vs. Interdependence.
  7.2.2 Increasing individualism in the modern Nepali society.
7.3 Passive Voice
7.4 Expressing counter arguments
7.5 Project Work

Unit 8: History **4 Hrs.**

8.1 Reading Comprehension: After the World Trade Centre
  8.1.1 Definition of Professional words
  8.1.2 Question- answer
8.2 Description of an event
8.3 Preposition
8.4 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
  9.1.1 Content Words
  9.1.2 Question - answer
9.2 Business letter
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
  10.1.1 Finding meaning in a dictionary
  10.1.2 Terminologies used in the stock market
  10.1.3 Question - answer
10.2 Writing Summary
10.3 Relative Clause
10.4 Describing process
10.5 Project Work

Section Two: Literature **20 Hrs.**

Unit One: Short Stories

1. Neighbors - Tim Winton
2. A Respectable Woman - Kate Chopin
3. A Devoted Son - Anita Desai 189

Unit Two: Poems

1. A Day - Emily Dickinson
2. Every Morning I Wake - Dylan Thomas
3. I Was My Own Route - Julia de Burgos

Unit Three: Essays

1. On Libraries - Oliver Sacks
2. Marriage as a Social Institution - Stephen L. Nock

References:

1. Panday, Ram Kumar. ***Yeti Tells.*** SajhaPrakashan.3rd edition. Kathmandu, 2050.
2. **Ancient Tales**.Ed, Lohani, Shreedhar P, Adhikari Rameshwar P and Subedi, Abhi N. Educational Enterprises Pvt Ltd: Kathmandu,1996.
3. **Grade 12 English.** Centre for Curriculum Development, Government of Nepal: Sano Thimi, 2077.
4. Poudel, R.C., A Manual to Communicative English, K.P. Pustak Bhandar, Kathmandu, 1956/57.
5. Shah, B.L., A text book of writing skills in English, First edition Hira Books Enterprises, Kathmandu,
6. Fruehling, R. T. and Oldham N. B., Write to the point, McGraw- Hill, Inc. New York NY 10020
7. Tayior, G., English conversation practice, 1975.
8. Maharjan L. B., A textbook of English sounds and Structures, Vidyarthi Pustak Bhandar, Kathmandu,2000.

9. Blundell, Jon, Higgens, Jonathan & Middlemiss, Nigel, Function of English, Oxford University Press
10. Better English Pronunciation, Cambridge University Press, New edition
11. Link English, Central Department of English, Tribhuvan University
12. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject.
13. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Final written exam marking scheme

Units	Title	Hours	Mark distribution*
Language Development			
1.	Critical thinking	4	5
2.	Family	4	5
3.	Sports	4	5
4.	Education	4	5
5.	Humor	4	5
6.	Hobbies	4	5
7.	Animal World	4	5
8.	History	4	5
9.	Leisure and Entertainment	4	4
10.	Fantasy	4	4
	Total	40	48
Literature			
1.	Neighbors - Tim Winton	3	7×2
2.	A Respectable Woman - Kate Chopin	3	
3.	A Devoted Son - Anita Desai	3	
4.	A Day - Emily Dickinson	1	6×1
5.	Every Morning I Wake - Dylan Thomas	1	
6.	I Was My Own Route - Julia de Burgos	1	
7.	On Libraries - Oliver Sacks	4	6×2
8.	Marriage as a Social Institution - Stephen L. Nock	4	
	Total	20	32

Mathematics I

(1103SH)

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

Semester: I **Lecture: 5 hours/week**

Tutorial: 1 hour/week

Practical: hours/week

Lab: hours/week

Course description:

This subject consists of four units related to trigonometry, co-ordinate geometry, algebra and calculus necessary to develop mathematical background helpful for the understanding and practicing the related works.

Course objectives:

After the completion of this course, student will be able to explain the concepts of the followings and apply them in the field of related area.

- Familiarize with the real number system and functional relation between parameters
- Explain the terms: Trigonometric equations, inverse circular functions and properties of triangles Progressions, permutations and combinations, binomial theorem, exponential and logarithmic series
- Define Straight lines, pair of lines and circle,
- Explain Sets, Limit and continuity, derivatives and anti-derivatives.

Course Contents:

Unit: 1: Set, Relation and Function **10 Hrs.**

1.1. Set, set notation, operation on sets
1.2. Venn diagram
1.3 Relation between sets
1.4 Real number system, absolute value of a real number
1.5 Functions and its types
1.6 Algebraic and transcendental function

Unit: 2: Trigonometry **15 Hrs.**

2.1. Review of trigonometrical functions
2.2. General solution of the equations sin x = k, cos x = k and tan x = k
2.3. Inverse circular function
2.4. Properties of triangles:
- The sine law, cosine law, tangent law, projection law
- The half formulae
- The area of triangle

2.5. Solution of triangle

Unit: 3: Algebra **10 Hrs.**

3.1 Progressions:
- A.P, G.P and H.P

3.2 Means
- A.M, G.M and H.M

3.3 Sum of infinite geometric series
3.4 Sum of natural number
3.5 Polynomial equations:
- Quadratic equation

- Nature of roots of quadratic equations
- Relation between roots and coefficients
- Formation of quadratic equation

Unit: 4: Co-ordinate Geometry **15 Hrs.**

4.1 Straight lines:

- Three standard forms of equation of straight lines
- Linear equation $Ax + By + C = 0$
- Any line through the intersection of two lines
- point of concurrencies

4.2 Pair of straight lines:

- The homogeneous equations of second degree representing a pair of straight lines through the origin
- Angle between two lines
- Bisector of the angles between two lines
- Condition that the general equation of second degree may represent a line pair
- Lines Joining the origin to the intersection of a line and a curve

4.3 Circle

- Equation of circle in standard forms
- Equation of tangent and normal

Unit: 5: Calculus **25 Hrs.**

5.1 Limits and continuity

5.2 Derivatives:

- By first principle or definition
- By power, sum, product, quotient rule, parametric and implicit function

5.3 Indefinite integrals:

- General or simple integral
- Integration by substitution method
- Integration by trigonometrical substitution method
- Integration by parts

5.4 Definite integral

Recommended textbooks:

- Basic mathematic for grade XI and XII
  By: B.C Bajracharya
- Fundamental of mathematics for grade XI and XII
  By: P.M Bajrachraya

Evaluation Scheme

Unit wise Marks division for Final Exam

S. N.	Units	Short questions (2 marks)	Long questions (4 marks)	Total Marks
1.	Set, Relation and Function	2x2 = 4	1x4=4	8
2.	Trigonometry	3x2 = 6	2x4=8	14
3.	Algebra	3 x 2 = 6	3 x 4 = 12	18
4.	Coordinate Geometry	2 x 2 = 4	3 x 4 = 12	16
5.	Calculus	4 x 2 = 8	4 x 4 = 16	24
		14 x 2 = 28	**13 x 4 = 52**	**80**

Physics I

(AG1104SH**)**

Year: I **Total: 7 hours /week**

Semester: I **Lecture: 4 hours/week**

Tutorial: 1 hour/week

Practical: hours/week

Lab: 2 hours/week

Course description

This course in physics is designed to provide students with an understanding of the scientific laws of our physical world and how the physical world and physics contribute to life's activities in modern society. The course emphasizes both quantitative and qualitative aspects of physics, involving mathematical models and equations. The application of physics to social and environmental situations is well illustrated.

The practical components of this course are designed to supplement learning through the application of learned theories. The students will handle simple apparatus to do simple measurements, demonstrate simple electrical circuits and apply their knowledge of physics in the real life.

Course objectives

On completion of the course the students will be able to:

- Sustain interest in physics and its application related to everyday experiences of their life.
- Identify the social, economic, environmental and other implications of physics.
- Describe physics as a coherent and developing framework of knowledge based on fundamental theories of the structures and processes of the physical world.
- Demonstrate the skills of experimenting, observing, interpreting data and evaluating evidence to formulate generalizations and models.
- Apply the knowledge of physical principles for familiar and unfamiliar situations.
- Apply facts, vocabulary and convention to unit measurements and common measuring instruments
- Explain the definitions, law concepts theories and models presented in this course.
- Describe the applications and implications of physical facts and principles.

After the completion of this semester course, students will be able to explain the basic concepts related to the followings and apply them in the field of the related agricultural area.

1. Mechanics.
2. Wave and Sounds.
3. Optics.
4. Electrostatics.

Minimum Standards:

The students must achieve a minimum of 40% accuracy in theory and 60% accuracy in practical.

Methodology of teaching:

Classroom instruction and demonstration, return demonstration models, solving related problems.

Evaluation methods:

Written and viva exams performance observation.

Course Contents:

Theory I

Unit 1. Mechanics: 30 Hrs.

1.1 Units and measurement: 3 Hrs.

- Units and Measurement of physical quantities.
- Fundamental units and instrument use to measure these quantities and derive units.
- Explain the physical concept of mass, length and time with relating them to various derive unit.
- Precision and accuracy of measurement.
- Various systems of units and their conversion.
- Express derived units in terms of fundamental units.
- Dimensional formula for various physical quantities.
- Application of dimensional equation.

1.2 Scalar and vectors: 2 Hrs.

- Scalar and vectors with examples.
- Vectors addition by parallelogram and triangle method.
- Resolve a vector into two components.
- The product of two vectors either results in a scalar quantity or a vector quantity.
- Simple numerical problems.

1.3. Kinematics: 4 Hrs.

- Displacement, velocity, instantaneous velocity, average and uniform velocity. and acceleration (retardation).
- Distance and displacement, speed and velocity.
- Kinematics equation of motion (linear and gravitational).
- The concept of projectile motion.
- simple numerical problems.

1.4. Force: 7 Hrs.

- Newton's laws of motions and their significance with examples.
- Law of Principle of conservation of linear momentum.
- Collision; introduction to Elastic and inelastic collision with example.
- Angular displacement, velocity and acceleration.
- Derivation of the relation $v=\omega r$.
- Vector nature of velocity and change of the direction of velocity in circular motion.
- The magnitude of centripetal force and centrifugal force, $F=mv^2/r=mr\omega^2$
- Friction, limiting friction, angle of friction and coefficient of friction.
- Law of limiting friction.
- The relation between angle of fraction and coefficient of fraction.
- Simple numerical problems.

1.5. Work, energy, and power: 2 Hrs.

- Definition and units of work, energy and power.
- Potential and kinetic energy.
- Conservative force.

- Law of conservation of energy and its application for falling body.
- Simple numerical problems.

1.6. Gravity and Gravitation: 3 Hrs.

- Laws of gravitation; $F=GMm/ R^2$.
- Acceleration due to gravity, mass and weight.
- Derive $g = GM/R^2$; the relation between gravitation constant and acceleration due to gravity.
- The variation of g due to height and depth.
- Center of mass and center of gravity.
- Constitutions of equilibrium of a body with examples.
- Formula of escape velocity (No derivation).
- Simple numerical problems.

1.7. Rotational dynamics of rigid bodies: 2 Hrs.

- Forces in equilibrium, torque, couple, C.G. and center of mass.
- Moment of inertia.
- Angular momentum and Its conservation with example.
- Work done by torque.
- Simple numerical problems.

1.8. Hydrostatics: 3 Hrs.

- Fluid pressure and determination of the formula $P=\rho gh$.
- Pascal's law.
- Density and specific gravity.
- Difference between density and specific gravity.
- Working principle of pumps; rotatory pump and lift pump.
- Archimedes' s principle and its uses.
- The Principle of flotation and condition of equilibrium for floating bodies.
- Atmospheric pressure with examples.

1.9 Properties of matter: 4 Hrs.

- Definition of elasticity.
- Statement of Hook's law of elasticity.
- Definition of stress, strain and Young's modulus of elasticity.
- Definition of viscosity.
- Statement of Newton's formula of viscosity.
- Definition of coefficient of viscosity.
- Derivation of unit and dimension of viscosity.
- Definition of terminal velocity.
- Definition of Adhesive force and cohesive force.
- Definition and explain surface tension.
- Capillary action with example (no derivation)
- Solve related numerical problems.

Unit 2. Wave and sound: 4 Hrs.

2.1. Wave motion:

- Definition of damped vibration, forced vibration and resonance.
- Definition of longitudinal wave, progressive wave and stationary wave.

- State progressive wave equation and stationary wave equation.
- Explanation of velocity of sound in medium and gas by Newton's formula & Laplace formula (no derivation).
- Effect of temperature, pressure & humidity on velocity of sound.
- Definition of harmonics and overtones.
- Concept of fundamental frequency and harmonics in organ pipes.
- End correction, Resonance and Resonance tube.
- Statement of laws of transverse vibration of string.
- Solve related numerical problems.

Unit 3. Light: 20 Hrs.

3.1. Reflection of light: 4 Hrs.

- The Phenomenon of reflection and hence state the laws of reflection of light.
- Regular and irregular reflection of light.
- The rotation of light by plane mirror.
- Properties of image formed by plane mirror.
- Real and virtual image.
- Sign convention for the focal length, object distance and image distance.
- The relation between radius of curvature and focal length.
- Mirror formula (using both mirror).
- Magnification (m) = I/O= v/u for mirrors.
- Image formation by spherical mirrors.
- Nature, size and position of the image formed by spherical mirrors at various positions of the object distance on the principal axis.
- Simple numerical problems.

3.2. Refraction of light: 7 Hrs.

- Phenomenon of refraction.
- Refractive index in terms of the speed of light in vacuum to the speed of light in medium.
- The relations ${}_a\mu^g \times {}_g\mu^a=1$.
- Refractive index in terms of real depth and apparent depth.
- The relation $d=t\,(1-1/\mu)$ and lateral shift $P = t[\sin(i-r)]/\cos r$.
- Derivation of the formula $\mu=1/\sin C$.
- Critical angle and conditions for total internal reflection.
- Examples of total internal reflection phenomena like mirage, light pipe.
- Prism, minimum deviation, angle of prism.
- The formula $A+\delta_m=i+e$ and $\mu= \sin (A+\delta_m/2/\sin A/2$.
- Uses of different types lens.
- Converging aspect of convex lens and diverging aspect of concave lens.
- Lens formula and lens maker's formula (No derivation).
- Simple numerical problem.

3.3. Optical instrument: 6 Hrs.

- Defects of vision- Myopia and Hypermetropia.
- Definition of angular magnification of telescope.
- Definition of astronomical telescope in normal adjustment.
- Simple microscope- Ray diagram and formula for magnification.
- Compound microscope – Ray diagram and formula for magnification.

- Explanation of dispersion of light.
- Definition of luminous flux, luminous intensity and illuminance, lumen, lux and candela.
- Statement of inverse square law of photometry.
- Solve related numerical problem.

3.4. Wave theory of light: 3 Hrs.

- Explanation of wave front and wavelets.
- Statement of Huygens's principle.
- Definition of coherent sources and interference.
- Path difference and phase difference.
- Definition of constructive and destructive interference.
- Definition of diffraction of light.
- Show formation of interference and diffraction fringes by diagram.

Unit 4. Electrostatics: 6 Hrs.

4.1. Electrostatics Field:

- Concept of electric charge.
- Statement of modern theory of electrification.
- Coulomb's law for point charges and derivation of the expression for force
  - Effects of permittivity on a medium between two-point charges
  - Electric field and normal electric flux.
- Potential and potential energy.
- Analogy between electric potential and gravitational potential.
- Electron volt and its use.
- Use of capacitor and its types.
- Definition of capacitance.
- Solved related numerical problems.

Physics Practical I (Laboratory) 30 Hrs.

(Any eight practical work out of ten should be accomplished)

1. Determine the volume of a hollow cylinder and a solid cylinder using Vernier calipers.
2. Determine the area of given glass rod and the volume of a steel ball using a micrometer screw gauge.
3. Verify Archimedes' principle; determine the specific gravity of solids (insoluble) heavier than water.
4. Verify the principle of laws of moment of forces and hence determine the weight of a given unknown body.
5. Verify the laws of reflection of light and find the relationship between object distance and image distance.
6. Verify laws of refraction and find the refractive index of glass slab
7. Verify laws of rotation of light.
8. Demonstrate the variation of lateral displacement with an angle of incidence in a rectangular slab.
9. Determine the refractive index of a prism using the 1-D curve method.
10. Determine the velocity of sound in laboratory using Resonance tube.

Recommended text:

- Brij Lai and Subramanyan, Principles of physics, *A text book of physics by Satya Prakash Part I & II*
- Nelkon and parker, advanced level physics (5^{th} ed.)
- Shrestha, U. P, Physics Practical Guide
- Shrestha, V.K. Numerical examples in physics Vol. I and II Ratna Pustak Bhandar, Nepal.

Reference Texts:

- Pradhan J.M. and gupta, S.K, A textbook of physics (part i and ii)
- Verma, H.C, Concepts of physics i &ii
- Sears, Zemansky & young, University physics
- Haliday, D &Resnickm R. Physics Part i &ii

Note: In case of an unavailability of above sources;

1. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject.
2. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Final written exam marking scheme

Unit	1	2	3	4	Total
Unit Hours	30	4	20	6	60
Marks	30	5	20	5	60

Chemistry I

(AG1105SH**)**

Year: I **Total: 7 hours /week**

Semester: I **Lecture: 4 hours/week**

Tutorial: 1 hour/week

Practical: hours/week

Lab: 2 hours/week

Course description:

This course is designed to give students the fundamental concept of physical, organic and in-organic chemistry. Emphasis is given to the principles related to chemistry within everyday life and to the application of chemistry in Agriculture science. An additional function of the course is to stimulate interest in the application of chemistry and to prepare the student for further study in this field. Chemistry practical acquaints the student with use of related laboratory equipment and provides practical application of learned theory, which is relevant to Forestry.

Course objectives:

Upon completion of the course the students will be able to:

- Explain the basic chemical changes involved in chemistry.
- Test the soil to increase the fertility with proper treatment.
- Apply the knowledge of chemistry for the production of improved quality & hygienic food.
- Utilize chemical principles in laboratory testing.
- Explain the photo-chemical responses that occur within the body during illness.
- Apply the theoretical & practical knowledge of phyto-chemistry, which is directly involved in human life.

Course Contents:

Theory

Unit: 1: General Chemistry: 7 Hrs.

1.1.Symbol:

- Definition
- Significance (qualitative and quantitative)

1.2.Formula:

- Definition
- Significance (qualitative and quantitative)
- Concept of valency in terms of combining capacity with H_2, O_2, and Cl_2
- Variable valency (ref. Fe, Sn, Pb, Cu, Hg, S and N)
- Radicals (electro- positive and electro - negative)
- Writing a formula

1.3.Chemical equation:

- Definition
- Types requisites
- Significance and limitation
- Balancing of chemical equation by hit and trial method and Partial equation method

Unit: 2: System of Classification: 20 Hrs.

2.1.Atomic structure:

- Subatomic particles (electron, proton and neutron)
- Rutherford's atomic model and its drawbacks
- Bohr's atomic model (postulates only)
- Mass number and atomic number
- Atomic weight and gram atomic weight
- Isotops and isobars
- Arrangement of electron in orbits (Aufbau principle)
- Concept of shell and sub shell, and orbits

2.2.Electronic theory of valency:

- Valence electron, duplet, octet and Noble gas electronic configuration
- The mode of formation and properties of compounds
  - Electrovalent
  - Covalent
  - Co-ordinate covalent
- Polar and non-polar covalent bond and compound
- Types and effect of Hydrogen bond

2.3.Oxidation and reduction:

- Classical and electronic concept of oxidation and reduction.
- Oxidant and reductant and oxidation number
- Importance of oxidant, reductant in Biological process, sterilization and disinfection, bleaching and spot removal.
- Examples of redox reaction
- Balancing a redox reaction by
  - oxidation number method
  - Ion-electron method

2.4.Periodic table:

- Modern periodic classification of elements.
- Location of s, p, d, f-block elements
- Periodicity in properties by:
  (i) Atomic radii
  (ii) Electro negativity
  (iii) Ionization potential
  (iv) Electron affinity
- Definition of Mendeleef's periodic law, advantage and anomalies of periodic table and modern periodic law.

2.5.Acid, Base and Salt:

- Characteristics of acid and base
- How acid neutralizes carbonate and neutralization of carbonate or bicarbonate by acid
- Arrhenius concept of acid and base
- Lowry and Bronsted concept of acid and base
- Conjugate acid and base
- Amphoteric nature of water
- Lewis concept of acid and base
- Definition of Salt
- Types of salt (normal, acidic and basic)

- Antacids and antabases and their medical uses
- Examples of acid and base in plants and their role

2.6.States of matter-Gaseous state

- Effect of pressure and temperature on volume of gas
- Boyle's law, Charles'slam combined gas law, Daltion law of partial pressure
- Simple derivation of ideal gas equation (PV=nRT)
- Diffusion of gas
- NTP or STP
- Kinetic theory of gases
- Related simple problems.

2.7.States of matter-Liquid State

- Unsaturated, saturated and supersaturated solution
- Solubility, Solubility charge and related numerical problems

2.8.States of matter-Solid State

- The deference between amorphous and crystalline solids
- Water of crystallization, deliquescent, hygroscopic, efflorescent, Isomorphism
- structure of NaCl crystal

2.9.Solutions-True solution

- Dilute and concentrated solution
- Diffusion of solute in solution, osmosis, osmotic pressure isotonic, hypotonic and hypertonic solution
- Biological importance of osmosis

2.10. Mole concept and chemical arithmetic

- Mole and Avogadros' number.
- Determination of percentage composition.
- Numerical related to the following relationships based upon chemical equation
- Mass-Mass relationship
- Mass-volume relationship
- Volume-volume relationship
- Calculation based on limiting reagent.

2.11. Environmental Chemistry

- The sources and adverse effects due to the following air pollutants- CO_2, SO_2, H_2S, Co, Hydrocarbon, Lead, cadmium dust, EFC, Oxides of nitrogen
- Indoor air pollution
- Effects of air pollution on -human health, materials and climate
- Pollutants of acid rain
- Adverse effects of acid rain
- Mode of water pollution
- Water pollutants- inorganic pollutants organic pollutants, domestic waste, industrial and agricultural waste, fluorides
- Effect due to water pollution
- Effect due to radioactivity
- Greenhouse effect

Organic chemistry **18 Hrs.**

3.1: An introduction to organic Chemistry

- Origin of organic chemistry-Vital force theory and modern theory
- Difference between organic and inorganic compound

- Sources of organic compound
- Importance of organic compound in Agriculture
  - Antipyretics
  - Analgesics
  - Antibiotic
  - Antimalarials
  - Tranquilizers
  - Germicides
  - Antiseptic found in plants.

3.2: Nomenclature of organic compounds

- Reason for large number of organic compounds-
  - Tetravalency
  - Catenation property
  - Isomerism
- Various types of organic compounds with their examples
- Functional group and its various types
- Homologous series with examples
- Prefix, primary suffix, secondary suffix, and principal functional group
- Naming aliphatic and aromatic compounds with IUPAC systems.
- Detection of foreign elements N, S and X

3.3: Isomerism

- Definition of isomerism.
- Structural isomerism of the types-
  - Positional
  - Functional
  - Metamerism
  - Chain isomerism

3.4: Organic reaction

- Carbocation and carbanion.
- Inductive effect (+1 and -1 effect)
- Hemolysis and heterolysis bond fission.
- Electrophones and Nucleophiles.
- Resonance.
- The types of organic reactions-Electrophonic and nucleophilic substitution, addition, elimination.

3.5: Hydrocarbons

A. Alkane

- The physical properties of alkanes (only methane)
- Chemical properties-halogenation combustion, phyrolysis
- Uses in everyday life

B. Alkene

- Laboratory preparation of ethane from ethanol
- The physical properties.

- The chemical properties-Combustion, halogenation, with Br_2 solution, with halogen acid (Test of double bond), with Baeyer's reagent, polymerization, ozonolysis
- Markovnikov's rule

C. Alkyne

- Laboratory preparation of ethyne from calcium carbide.
- Physical properties of acetylene
- Chemical properties-Combustion, hylogenation, catalytic hydration, with Br_2 solution, with Na, with tollens reagent, with Bayer's; reagent, ozonlysis polymerization, with Cl_2
- Markovnikov's rule.
- Uses of ethyne in life

3.6 Alkyl halides

- Definition of alkyl halides. With example.
- uses of alkyl halides

3.7: Alcohol

- Classification of alcohol as- monohydric, dihydric, polyhydric, primary, secondary and tertiary
- Identification of primary, secondary and tertiary alcohol by oxidation method
- Physical properties of ethanol
- Chemical properties- Oxidation, with sodium, with oxygen, with H_2SO_4, CH_3COCl, CH_3COOH, combustion

Practical (Laboratory)

1. Simple Glass Working 6 Hrs.
    a. to cut the glass tube into three equal parts and round up their shape edges
    b. to bore a hole through a cork
    c. to bend the glass tubing into acute, obtuse and right angle
    d. to draw a jet and capillary tube
    e. to fit up a wash bottle
2. Separate sand and common salt in pure and dry states from mixture of sand and common salt. 2 Hrs.
3. Separate sand and camphor from a mixture of sand and camphor. 2 Hrs.
4. Recover the precipitate obtained in pure and dry state when the given solution -A is treated with excess of solution-B
    i. Solution-A= $BaCl_2$
    ii. Solution-B =H_2SO_4 2 Hrs.
5. Prepare a sample of clearly pure distilled water from impure water and carry out the test for purity of water thus prepared. 2 Hrs.
6. Prepare a sample of bazaar copper sulphate at laboratory temperature and use the solution to get pure crystals of salts. 2 Hrs.
7. Obtain sodium chloride by the neutralization of:
    i. Bench of hydrochloric acid with a bench of sodium hydroxide.
    ii. Sodium carbonate with hydrochloric acid 2 Hrs.
8. Prepare a soluble derivative of barium carbonate and sodium chloride. 2 Hrs.

9. To determine the equivalent weight of reactive metal by hydrogen displacement method. 2 Hrs.
10. To prepare and study the properties of hydrogen gas 2 Hrs.
11. To prepare and study the properties of ammonia gas 2 Hrs.
12. To detect the acid radicals (Cl^-, NO_3^{--}, SO_4^{---}, CO_3^{--}) by dry and wet ways 4Hrs.

Textbooks:
1. A Text book of Chemistry, Jha and Guglani
2. Foundations of Chemistry, Vol. 1, M.K. Sthpit and R.R. Pradhananga

References:
1. Fundamentals of Chemistry, K.R. Palak
2. Inorganic Chemistry, Bahl and Tuli
3. A Text book of Engineering Chemistry, R.S. Sharma
4. A Textbook of Inorganic Chemistry, L.M. Mitra
5. Elementary practical chemistry, M.K Sthapit

Other learning materials:
1. Other references to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject

Note: The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Final written exam marking scheme

Unit	1	2	3	Total
Unit Hours	12	28	20	45
Marks	10	30	20	60

Zoology I

(AG1106SH**)**

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

Semester: I **Lecture: 4 hours/week**

Tutorial: hour/week

Practical: hours/week

Lab: 2 hours/week

Course description:

This basic course in zoology discusses the characteristics of unicellular and multicellular structures. The course contains introductory zoology, cell biology, the study of different types of tissues, animal diversity, evolution of organisms, anatomy and physiology of earthworm and economically important insects.
Practical zoology includes study of microscope, museum specimens of invertebrates and invertebrates, permanent slides of animal tissues, temporary mount, and dissection of earthworm.

Course objectives:

Theory and Practical zoology course content has been designed, with the objective that

- Students become proficient in identification of common organisms with their local Nepali, common English and scientific names.
- Tell the meaning, scope and different branches of zoology and relation with other branches of science.
- Explain structure and function of different kinds of tissues in a body
- Classify diversified forms of animal life.
- Explain different anatomical and physiological characteristics of mammals
- Describe how organisms of today have been evolved from the ancestral ones
- Handle microscope properly
- Prepare temporary slide mount of the given specimen
- Dissect the animal so as to expose its different organ systems.

Course Contents:

Theory [60 Hours]

Unit 1. Introduction to Zoology **2 Hrs.**

1.1. Definition, scope and branches of Zoology

1.2. Meaning of zoology, Scope of zoology, link with physics, chemistry and other sciences

1.3. Different branches of zoology: Morphology, anatomy, physiology, cytology, Histology, embryology, Hepatology, Herpetology, parasitology, entomology, Helminthology, proto-zoology, Bacteriology, virology, paleontology, ecology, genetics, toxicology

1.4. Introduction to Preservation Techniques

1.4.1 Definition and importance of preservation

1.4.2 Types of common preservation techniques- Wet and Dry methods

1.4.3 Protocol of following preservation techniques:

1.4.4 Dry and Wet preservation for different groups of organisms-Lower invertebrates; higher invertebrates- arthropods, Mollusca's, Echinodermata; Vertebrates

1.4.5 Taxidermy

Unit 2. Cell Biology **14 Hrs.**

2.1. Introduction to Cell

2.1.1. Basic structure of prokaryotic and eukaryotic cell

2.1.2. Structure of different cell organelles and their functions: Cytoplasmic contents: cell membrane, mitochondria, endoplasmic reticulum, Golgi complex, liposome, centrosome, vacuoles, cilia and flagella; Nucleoplasm contents: chromosomes, nucleolus, nuclear membrane

2.1.3. Meaning of Cyclosis, endocytosis, exocytosis

2.2. Cell Division

2.2.1. Definition of cell cycle and explain the stages of cell cycle

2.2.2. Types and description of cell division: Amitosis, mitosis and meiosis cell divisions.

2.2.3. Explain the different stages of Mitosis and Meiosis with salient features and diagrammatic representation of each stage

2.2.4. Explain the importance of different types of cell division: Amitosis, Mitosis and Meiosis.

2.2.5. Role of meiosis in gametogenesis-define gametogenesis; types of gametogenesis and significance of meiosis in gametogenesis in sexually reproducing organisms

2.3. Tissues and their types

2.3.1. Definition of tissue and describe its types.

2.3.2. Describe basic structure, types, function and location of epithelial tissues in human body. e.g. simple, squamous, cuboidal epithelium, Functions of epithelial tissues i.e. protection, secretion, excretion, absorption and exchange of different materials

2.3.3. Describe basic structure, types, function and location of Connective tissues in human body- only list the types of connective tissue

2.3.4. Describe basic structure, types, function and location of Muscular tissues in human body.

2.3.5. Describe basic structure, function and location of Nervous tissues in human body.

2.3.6. Flow chart of types of tissues and its subtypes

Unit 3 Diversity of Animal Life **11 Hrs.**

3.1. Concept of Taxonomy

3.1.1. Definition of taxonomy, species as a basic unit of classification, systematics, taxon, lower and higher taxa, order of different taxa

3.1.2. Describe the evolution of system of classification and need for classification.

3.1.3. Different systems of classification- Artificial, Natural and Modern classification.

3.1.4. Basis of classification in different systems

3.1.5. Differences between artificial and natural systems of classification

3.2. Binomial Nomenclature and Classification

3.2.1. Describe the need for scientific nomenclature

3.2.2. What is ICZN- International Code of Zoological Nomenclature, it’s role

3.2.3. Binomial system of nomenclature adopted by Carolus Linnaeus (1707-1778). Selected examples of binomial nomenclature of animals- Grasshopper, Rat, Rabbit, Lion; Tiger, Leopard, Fox, Cat, Dog,

3.2.4. Five kingdom system of classification.

Chief characteristics (Habit and habitat; organization of organism, nutrition, mode of reproduction) with examples of five kingdoms.

Unit 4 Animal phylogeny and classification 12 Hrs.

4.1. General characteristics and classification of different phyla of animals.

4.1.1 General characters of phylum Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Chordata.

4.1.2 List the classes of each phylum and two common examples of each.

Unit 5 Basic concept of origin and evolution of life. 12 Hrs.

5.1. Describe origin of life and its theories: Oparin and Haldane theory; Miller-Urey experiment

5.2. Define evolution and organic evolution

5.3. Evidences of organic evolution: morphological, anatomical, paleontological, biochemical, genetic and embryological.

5.4. Describe different theories of organic evolution-

5.4..1. Lamarck Theory of organic evolution, example and limitations of the theory

5.4..2. Darwinism/ Theory of Natural selection and Neo Darwinism/ modern Synthetic theory with example and drawbacks of Darwinism

5.5. Geological time period and evolutionary tree of humans

5.6. Describe different stages of evolution of Man and highlight the key features: Proconsul; Dryopithecus; Ramapithecus; Shivapithecus; Australopithecus; Mordern human ancestors such as Homo habilis; Homo erectus; Java man (Homo erectus or pithecanthropus erectus); Peking man (Homo erectus pekinensis or Sinanthropus pekinensis); Neanderthal man (Homo sapiens neanderthalensis); Cro-Magnon man; Modern man

Unit 6 Study of Earthworm 5 Hrs.

1.1. Systematic position habit, habitat, external features.

1.2. Structure, organs and physiology of digestive system, reproductive system, and nervous system

1.3. Economic importance of earthworm.

Unit 7 Study of some economically important insects. 4 Hrs.

7.1. Systemic position, habit and habitat, morphological structure, life cycle and economic importance of

7.1.1 Honeybee and

7.1.2 Silkworm.

Practical [30 Hrs.]

Unit 1 Use of the microscope 4 Hrs.

1.1. Description of importance of microscope, it's types, parts of microscope & functions of its different parts, observation techniques.

1.2. Proper handling of microscope.

1.3. Explain the concept of magnification.

Unit 2 General study of the animal kingdom **14 Hrs.**

2.1. Study of permanent slides and museum specimens (Invertebrata-Paramecium, Amoeba, Plasmodium & it's lifecycle; Sycon; Hydra; Tapeworm and it's life cycle; Round worm & it's life cycle; Liver fluke; Earthworm; Leech; common arthropoda specimens; Snail; Starfish. Chordata- Rohu, Flying fish; frog, tree frog; lizard; snake; Pigeon; Parrot; Rat; Squirrel

2.2. Identification of common insects, other animals in agricultural ecosystem

2.3. Identification of common birds in agricultural ecosystem

Unit 3 Study of Animal Tissues **6 Hrs.**

2.1. Microscopic observation of permanent slides of animal tissues

2.2. Preparation of temporary slide of cheek and it's study

Unit 4 Dissection of animal **6 Hrs.**

4.1. Dissection of earthworm

4.2. Temporary mount of setae of earthworm

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	Total
Unit Hours	2	14	11	12	12	5	4	60
Marks	5	15	10	10	10	5	5	60

Botany I

(AG1107PS)

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

Semester: I **Lecture: 4 hours/week**

Tutorial: hour/week

Practical: hours/week

Lab: 2 hours/week

Course description:

This subject consists of four units related to introduction to botany, molecular biology, taxonomy and biodiversity, and economic botany to develop background in botany that supports for the understanding and practicing the related Agricultural works.

Course objectives:

After the completion of this course, students will be able to explain the basic concepts related to the followings and apply them in the field of related Agricultural area.

1. Introduction to botany
2. Molecular biology
3. Taxonomy and biodiversity
4. Economic botany

Course Contents:

Theory

Unit 1. Introduction to botany: **3 Hrs.**

1.1. Definition and Scope of Botany

1.2. Importance of Botany

1.3. Branches of Botany

1.4. Discuss the relation of Botany with other sciences like Physics, Chemistry, Statistics etc.

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

2.1 Life Components 1 Hr.

- Define the terms cellular pool, biomolecules, micro molecules and macro molecules with examples.
- List inorganic and organic molecules of the living system
- Define monomers and polymers with examples.

2.2 Water: 1Hr.

- Structure, properties and biological role of water.

2.3 Carbohydrates: 2 Hrs.

- Define carbohydrates.
- Define glycosidic bond.
- Define monosaccharide, oligosaccharides, and polysaccharides with examples.
- List functions of carbohydrates

2.4 Proteins 2 Hrs.

- Define proteins as polypeptides.
- Define essential and non-essential amino acids with examples.
- Define peptide bonds.
- Define primary, secondary and tertiary structure of protein.
- Define denaturation and renaturation of proteins.

- List functions of proteins.

2.5 Lipids 2 Hrs.
- Define lipids as triglycerides.
- Define saturated and unsaturated fatty acids.
- Differentiate fats and oils.
- Define phospholipids.
- List functions of Lipids.

2.6 Nucleic Acids: 3 Hrs.
- Define nucleic acids as polynucleotides.
- List components of Nucleotides.
- Define phosphodiester bond.
- Define and differentiate DNA and RNA.
- List function of Nucleic acids.

Unit 3. Taxonomy and Biodiversity: 41 Hrs.

3.1 Concepts of Taxonomy: 2 Hrs.
- Define plant taxonomy.
- Give importance of plant taxonomy.
- Identify taxonomic hierarchy and categories in plant classification with examples.
- Define binomial system of nomenclature.

3.2 System of classification 2 Hrs.
- Define artificial, natural and phylogenetic systems of classification with examples and their differences.

3.3 Concepts of Biodiversity: 3 Hrs.
- Define biodiversity.
- Discuss importance of conserving biodiversity.
- Give levels of biodiversity- ecosystem and habitat diversity, species diversity and genetic diversity.
- Give the latest status of biodiversity of Nepal.
- List protected plant species in Nepal.
- Define endemic species and list the endemic species of Nepal.

3.4 Virus: 4 Hrs.
- Define virus.
- Give general characteristics of virus.
- Give classification of virus on the basis of host and genetic material.
- Give structure of a Bacteriophase.
- Summarize the process of viral replication.
- Describe the mode of transmission of virus.
- List some viral diseases in plants.
- Describe the economic importance of virus

3.5 Bacteria and Cyanobacteria 4 Hrs.
- Define bacteria and give general characteristics of bacteria.
- Give classification of bacteria based on shape, Gram staining and mode of nutrition.
- Describe the economic importance of bacteria.

- Define cyanobacteria and give general characteristics of cyanobacteria with example.
- Describe the economic importance of cyanobacteria.

3.6 Fungi 4 Hrs.

- Define fungi.
- Give general characteristics of fungi.
- Outline the classification of fungi.
- Describe life cycle of Yeast with labeled diagram.
- Describe economic importance of Fungi.

3.7 Algae 4 Hrs.

- Define Algae.
- List general characteristics of Algae.
- Give three major classes of Algae- Chlorophyceae, Phaeophyceae and Rhodophyceae with their chief distinguishing features.
- Describe structure, reproduction and life cycle of Spirogyra.
- Describe economic importance of Algae.

3.8 Bryophytes 3 Hrs.

- Define Bryophyta.
- Give general characteristics of Bryophyta.
- Classify Bryophytes as liverworts, hornworts and mosses.
- List economic importance of Bryophyta.
- Give structure, reproduction types of Marchantia.

3.9 Pteridophytes 3 Hrs.

- Define Pteridophyta.
- Give general characteristics of Pteridophyta.
- Describe the types of reproduction found in pteridophytes.
- Give economic importance of Pteridophytes.

3.10 Gymnosperm 2 Hrs.

- Define Gymnosperms.
- Give general characteristics of Gymnosperms.
- List major groups of living Gymnosperms with examples of representative species.
- Give economic importance of Gymnosperms.

3.11 Angiosperm 1 Hr.

- Define Angiosperms.
- Give general characteristics of Angiosperms.
- List differences between dicotyledons and monocotyledons.

3.12 Morphology of Angiosperm 4 Hrs.

- Description of angiospermic plants in semi technical terminologies. habit; general types, parts, features, modifications of root, stem, Leaf, inflorescence, flower and fruits.

3.13 Study of some Angiosperm families 5 Hrs.

- Discuss the characteristic features of some common Angiosperm families with examples and economic importance:
- Poaceae, Cruciferae, Solanaceae, Fabaceae.

Unit 4. Economic Botany: 5 Hrs.

4.1 Food Plants: 2 Hrs.

- List some important food plants of Nepal and their parts used as food value. (Cereals, Pulses, Vegetables, Fruits)

4.2. Medicinal Plant: 2 Hrs.

- List some important medicinal plants of Nepal and their parts used.

4.3. Concepts of Ethnobotany 1 Hr.

- Define the term 'ethnobotany'.
- Discuss the value and importance of traditional knowledge.

Practical (Laboratory) 30 Hrs.

Practical 1: Molecular Biology

- Test presence of reducing sugars in the given sample using Benedict's solution.
- Test presence of starch in given sample using Iodine solution.
- Test presence of protein in given sample using Biuret method.
- Test presence of lipid in given sample using emulsion method.

Practical 2: Taxonomy and Biodiversity

Monera:

- Study the different types of bacteria based on their morphology using permanent slides.
- Study the filaments of *Nostoc* using compound microscope.

Fungi:

- Study yeast cells and their budding under compound microscope.

Plantae:

- Study structure and conjugation in *Spirogyra* using compound microscope.
- Study vegetative structure and stages of reproduction in *Marchantia* using fresh materials, preserved specimens and permanent slides.
- Study the vegetative structure and reproductive stages of fern including herbarium specimen of sporophyte, slide of v. s. of leaf through sorus, and prothallus.

Taxonomy of Angiosperms:

- Study different types of modification of root, stem and leaf.
- Describe the representative plants of angiospermic families in semi-technical terms (Brassicaceae, Solanaceae, Fabaceae, and Poaceae).

Recommended Textbooks:

1. Dutta, A. C. *A Class book of Botany*. Oxford University Press, Calcutta.
2. Pandey, S. N. and P. S. Trivedi. *A Textbook of Botany* (Vol 1). Vikas Publishink House Pvt Ltd, New Delhi, India.
3. Pandey, S. N. and P. S. Trivedi. *A Textbook of Botany* (Vol 2). Vikas Publishink House Pvt Ltd, New Delhi, India.
4. Pandey, B. P. *Taxonomy of Angiosperms.* Chand and Company Ltd, New Delhi, India.
5. Mahat, Ras Bihari, *A text book of Biology part I and Part II*
6. Chaudhary, R. P. *Biodiversity in Nepal Statud and Conservation.* S. Devi, Saharanpur (U. P.), India and Tec press Books, Bangkok, Thailand.

7. Pandey, B. P. *Economic Botany.* S. Chand and Company Ltd, New Delhi, India.
8. Lawerence, C. H. M., *Taxonomy of Vascular Plants.* McMillan Company.
9. Vasishta, P. C. *Botany for Degree Students (vol 5) Gymnosperms.* S. Chand and Company Ltd, New Delhi, India.
10. Jain, J. L. *Fundamentals of Biochemistry.* S. Chand and Company Ltd, New Delhi, India.
11. HMG, Nepal. *Medicinal Plants of Nepal.* DPR, HMG, Nepal.

Learning materials:

1. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject.
2. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Final written exam marking scheme

Unit	1	2	3	4	Total
Unit Hours	3	11	41	5	60
Marks	5	10	40	5	60

First Year/Second Semester

English II

1201 SH

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

Semester: II **Lecture: 4 hour/week**

Practical: hours/week

Course Description:

This course is designed with a view to provide students techniques in using English for academic and communicative purposes, train them in the comprehending varieties of texts, terminologies, grammatical and communicative areas of English language, make them see the relationship between structure and meaning. This guides the students from general to comprehensive understanding of language.

Course Objectives:

On completion of the course the students will be enabled to:

1. Construct sensible sentences applying the grammatical structures.
2. Answer the questions given after the comprehension passage.
3. Use terminologies vocabularies to construct sensible sentences.
4. Perform the communicative functions in given situation.
5. Write paragraphs on people, place and events correctly and meaningfully.
6. Analyze the literary texts.

Section One: Language Development **40 Hrs.**

Unit 1: Technology **4 Hrs.**

1.1 Reading comprehension: Hyper loop
- 1.1.1 Use of technological terms
- 1.1.2 Use of prefixes
- 1.1.3 Question- answer

1.2 Issuing a press release

1.3 Subject Verb agreement

1.4 Summarizing

1.5 Project Work

Unit 2: Money and Economy **4 Hrs.**

2.1 Reading comprehension: QR Code
- 2.1.1 Use of terminologies
- 2.1.2 Abbreviations
- 2.1.3 Vowel sounds
- 2.1.4 Question- Answer

2.2 Writing a news article

2.3 Questions:
- 2.3.1 Yes/no questions
- 2.3.2 Wh - questions
- 2.3.3 Indirect and direct questions

2.4 Expressing necessity

2.5 Project Work

Unit 3: Human Culture **4 Hrs.**

3.1 Reading Comprehension: Land of Plenty
- 3.1.1 Word Formation: Root, Prefixes and prefixes
- 3.1.2 Question-answer

3.2 Writing:
- 3.2.1 Paragraph
- 3.2.2 Letter to the editor

3.3 Adjectives and Adverbs
3.4 Making comparison and contrast
3.5 Project Work

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

4.1 Reading Comprehension: Living in a Redwood Tree
- 4.1.1 Terminologies used in ecology
- 4.1.2 Compound words
- 4.1.3 Question - answer

4.2 Writing a book/film review
4.3 Reported Speech
4.4 Reporting
4.5 Project Work

Unit 5: Career Opportunities **4 Hrs.**

5.1 Reading Comprehension: Presenting Yourself
- 5.1.1 Employment-related terminologies
- 5.1.2 Answering questions

5.2 Writing job application with CV
5.3 Conditional Sentences
5.4 Clarifying
5.5 Project Work

Unit 6: Human Rights **4 Hrs.**

6.1 Reading Comprehension: "I am Sorry"- The Hardest Three Words to Say
- 6.1.1 Word formation
- 6.1.2 Question-answer

6.2 Writing Paragraphs on Steps on making education equal
6.3 Connectives
6.4 Group work: Criticizing
6.5 Project Work

Unit 7: War and Peace **4 Hrs.**

7.1 Reading comprehension: Train to Pakistan
- 7.1.1 Terminologies
- 7.1.2 Question -answer
- 7.1.3 Vowels: Monophthongs and diphthongs

7.2 Describing People, place or event
7.3 Past simple, Past continuous, Past perfect, Past perfect continuous tense
7.4 Group work: Making Announcements
7.5 Project Work

Unit 8: Music and Creation **4 Hrs.**

8.1 Reading Comprehension: A Life of Sound and Silence
- 8.1.1 Terminologies used in music
- 8.1.2 Word Stress
- 8.1.3 Question -answer

8.2 Writing a bibliography.

8.3 Preposition of time
8.4 Group work: Predicting
8.5 Project Work

Unit 9: Migration and Diaspora **4 Hrs.**

9.1 Reading Comprehension: Dediasporization: Homeland and Hostland
- 9.1.1 Consonants: Voiced and voiceless sounds
- 9.1.2 Stressed an unstressed syllable
- 9.1.3 Question - answer

9.2 Interpreting data in charts and graphs
9.3 Would/ Used to
9.4 Narrating past events
9.5 Project Work

Unit 10: Power and Politics **4 Hrs.**

10.1 Reading Comprehension: An Open Letter to Mary Daly
- 10.1.1 Terminologies used in politics
- 10.1.2 Consonant cluster
- 10.1.3 Question- answer

10.2 Writing an article for a newspaper
10.3 Adjective order
10.4 Pair work: Denying
10.5 Project Work

Section Two: Literature **20 Hrs.**

Unit One: Short Stories

1. The Treasure in the Forest - H. G. Wells
2. My Old Home - Lu Xun
3. The Half-closed Eyes of the Buddha and the Slowly Sinking Sun -Shankar Lamichhane
4. A Very Old Man with Enormous Wings - Gabriel Garcia Marquez

Unit Two: Poems

1. The Awakening Age - Ben Okri
2. Soft Storm – Abhi Subedi

Unit Three: Essays

1. Knowledge and Wisdom - Bertrand Russell
2. Humility - Yuval Noah Harari
3. Human Rights and the Age of Inequality - Samuel Moyn

References:

1. Panday, Ram Kumar. ***Yeti Tells.*** SajhaPrakashan.3rd edition. Kathmandu, 2050.
2. **Ancient Tales**.Ed, Lohani, Shreedhar P, Adhikari Rameshwar P and Subedi, Abhi N. Educational Enterprises Pvt Ltd: Kathmandu,1996.
3. **Grade 12 English.** Centre for Curriculum Development, Government of Nepal: Sano Thimi, 2077.
4. Poudel, R.C., A Manual to Communicative English, K.P. Pustak Bhandar, Kathmandu, 1956/57.
5. Shah, B.L., A text book of writing skills in English, First edition Hira Books Enterprises, Kathmandu,
6. Fruehling, R. T. and Oldham N. B., Write to the point, McGraw- Hill, Inc. New York NY 10020

7. Tayior, G., English conversation practice, 1975.
8. Maharjan L. B., A textbook of English sounds and Structures, Vidyarthi Pustak Bhandar, Kathmandu,2000.
9. Blundell, Jon, Higgens, Jonathan & Middlemiss, Nigel, Function of English, Oxford University Press
10. Better English Pronunciation, Cambridge University Press, New edition
11. Link English, Central Department of English, Tribhuvan University
12. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject.
13. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Evaluation Scheme

Units	Title	Hours	Mark distribution
Language Development			
1.	Technology	4	5
2.	Money and Economy	4	5
3.	Human Culture	4	5
4.	Ecology and Environment	4	5
5.	Career Opportunities	4	5
6.	Human Rights	4	5
7.	War and Peace	4	5
8.	Music and Creation	4	5
9.	Migration and Diaspora	4	4
10.	Power and Politics	4	4
Total		**40**	**48**
Literature			
1.	The Treasure in the Forest - H. G. Wells	3	7×2
2.	My Old Home - Lu Xun	3	
3.	The Half-closed Eyes of the Buddha and the Slowly Sinking Sun -Shankar Lamichhane	3	
4.	A Very Old Man with Enormous Wings - Gabriel Garcia Marquez	3	
5.	The Awakening Age - Ben Okri	1	6×1
6.	Soft Storm – Abhi Subedi	1	
7.	Knowledge and Wisdom - Bertrand Russell	2	6×2
8.	Humility - Yuval Noah Harari	2	
9.	Human Rights and the Age of Inequality - Samuel Moyn	2	
Total		**20**	**32**

Mathematics II

(1202SH)

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

Semester: II **Lecture: 5 hours/week**

Tutorial: 1 hour/week

Practical: hours/week

Lab: hours/week

Course description:

This subject consists of five units related to vectors, algebra, calculus, geometry and statistics necessary to develop mathematical background helpful for the understanding and practicing the related works.

Course objectives:

After the completion of this course, student will be able to explain the concepts of the followings and apply them in the field of related area.

- Explain the vectors in plain and vectors in space.
- Describe complex numbers and its different forms, matrics and determinats.
- Apply derivatives and area of curves.
- Explain the parabola and co-ordinates of space and planes.
- Describe statistics.

Course Contents:

Unit: 1: Vectors **15 Hrs.**

1.1 Vectors and its types
1.2 Components of vector in two dimensions
1.3 Vectors in space
1.4 Unite vectors I, j, k
1.5 Product of two vectors
    - Dot product
    - Cross product

Unit: 2: Algebra **20 Hrs.**

2.1. Permutation and combination
2.2. Binomial theorem, Exponential and logarithmic series
2.3. Complex numbers:
    - Conjugate and its properties
    - Modulus and its properties
    - Polar form
    - De moivre's theorem and its application
    - Cube roots of unity and its properties

2.4 Matrices and Determinants:
    - Algebra of matrices
    - Properties of determinant
    - Solution of linear equation using cramer's rule
    - Row equivalent matrix method

Unit: 3: Geometry **15 Hrs.**

3.1 The parabola:

- Standard equations
- Tangent and normal

3.2 Co-ordinates in space

3.3 Co-ordinates in plane

Unit: 4: Calculus **15 Hrs.**

4.1 Applications of derivative:

- Tangents and normal to a curve taking slope as derivative
- Maxima and minima of a function
- Derivatives as a rate measure

4.2 Applications of anti-derivative:

- Definite integrals as a limit of sum
- Area bounded by a curve and X-axis or Y- axis
- Area bounded by two curves
- Area bounded by the closed curves

Unit: 5: Statistics and Probability **10 Hrs.**

5.1 Statistics

- Measures of central tendency
- Measures of dispersion
- Correlation and regression

5.2 Probability:

- Concept of probability
- Addition and multiplication
- Concept of conditional probability

Recommended textbooks:

- Basic mathematics for grade XI and XII, By: B.C. Bajracharya
- Fundamental of mathematics for grade XI and XII, By: P.M Bajrachraya

Evaluation Scheme

Unit wise Marks division for Final Exam

S. No.	Units	Short questions (2 marks)	Long questions (4 marks)	Total Marks
1.	Vectors	2 x 2 = 4	3 x 4 = 12	18
2.	Algebra	4 x 2 = 8	4 x 4 = 16	24
3.	Geometry	2 x 2 = 4	2 x 4 = 8	12
4.	Calculous	2 x 2 = 4	3 x 4 = 12	12
5.	Statistics and Probability	2 x 2 = 4	2 x 4 = 8	12
		12x 2 = 24	**14 x 4 = 56**	**80**

Physics II

(AG1203SH**)**

Year: I **Total: 7 hours /week**

Semester: II **Lecture: 4 hours/week**

Tutorial: 1 hour/week

Practical: hours/week

Lab: 2 hours/week

Course description

This course in physics is designed to provide students with an understanding of the scientific laws of our physical world and how the physical world and physics contribute to life's activities in modern society. The course emphasizes both quantitative and qualitative aspects of physics, involving mathematical models and equations. The application of physics to social and environmental situations is well illustrated.

The practical components of this course are designed to supplement learning through the application of learned theories. The students will handle simple apparatus to do simple measurements, demonstrate simple electrical circuits and apply their knowledge of physics in the real life.

Course objectives

On completion of the course the students will be able to:

- Sustain interest in physics and its application related to everyday experiences of their life.
- Identify the social, economic, environmental and other implications of physics.
- Describe physics as a coherent and developing framework of knowledge based on fundamental theories of the structures and processes of the physical world.
- Demonstrate the skills of experimenting, observing, interpreting data and evaluating evidence to formulate generalizations and models.
- Apply the knowledge of physical principles for familiar and unfamiliar situations.
- Apply facts, vocabulary and convention to unit measurements and common measuring instruments
- Explain the definitions, law concepts theories and models presented in this course.
- Describe the applications and implications of physical facts and principles.

After the completion of this semester course, students will be able to explain the basic concepts related to the followings and apply them in the field of the related agricultural area.

1. Current Electricity.
2. Magnetism.
3. Heat.
4. Modern Physics.

Minimum Standards:

The students must achieve a minimum of 40% accuracy in theory and 60% accuracy in practical.

Methodology of teaching:

Classroom instruction and demonstration, return demonstration models, solving related problems.

Evaluation methods:

Written and viva exams performance observation.

Course Contents:

Theory

Unit 1. Current Electricity: 14 Hrs.

1.1 Electric Current: 3 Hrs.

- Current as the rate of flow charge.
- Potential deference.
- Ohm's law and its verification.
- Expression $R=R_1+R_2+R_3+$.....and $1/R=1/R_1+1/R_2+1/R_3$ +..... in series and parallel combination.
- Conversion of a galvanometer into ammeter and voltmeter.
- Ohmic and non-Ohmic conductors from I-V curve.
- Wheat stone bridge and its principle; balance condition. (Using concept of p.d. equal in balanced state).
- Application of wheat stone bridge.
- Conversion of galvanometer into voltmeter and ammeter.
- Simple numerical problems.

1.2 Resistance and heat: 3 Hrs.

- Joule's laws of heating and derivation of the equation H=i2Rt/J.
- Heat production in resistance wire due to passage of current.
- Electric power in terms of energy dissipated in a time in the resistance wire.
- Meaning of e.m.f and internal resistance of a cell relation E=V+Ir.
- Electric power, watt, kilowatt, kilowatt-hour and horsepower.
- Meaning of joule's conversion factor - joule’s constant.
- Simple numerical problems.

1.3. Electromagnetism: 4 Hrs.

- Explanation of Oersted's discovery, direction of current and field.
- Dependence of force on physical factors.
- Find force on moving charge.
- Motion of Moving charge in magnetic field in perpendicular direction.
- Statement of principle of moving coil galvanometer.
- Definition of electromagnetic induction.
- Statement of Faraday's laws of electromagnetic induction.
- Statement of Lenz's law.
- Principle and working of a.c. generator.
- Solve related numerical problems.

1.4. Alternating Current: 4 Hrs.

- AC and DC importance of AC over DC.
- Expression irms, vrms and imean, vmean with peak value.
- Reactance and impedance for different a.c Circuit. (No derivation).
- Resonance in A.c Circuit (Condition).
- Working of a transformer and energy loss mechanisms in transformers.
- Simple numerical problems.

Unit 2. Magnetism: 8 Hrs.

2.1 Fundamentals of Magnetism:

- Magnet and its properties.

- Magnetic lines of force and its properties. Magnetic field strength.
- Various types of magnets and their positions of poles.
- Coulomb's law for magnetism.
- Neutral point.
- Magnetic field intensity due to bar magnet at End on position, Board side on position.
- Lines of force around a bar magnet and the natural point.
- Uniform and non-uniform magnetic field.
- Definition of hysteresis loop, Coercivity and retentivity. Nature of hysteresis loop of different material.
- Dip, declination, horizontal and vertical components of earth's magnetic field.
- Properties of dia, para and ferromagnetic materials.
- Definition of luminous flux, luminous intensity and illuminance, lumen, lux and candela.
- Statement of inverse square law of photometry.
- Solve related numerical problem.

Unit 3. Heat: 18 Hrs.

3.1. Thermometry: 2 Hrs.

- Concept of heat and temperature.
- Explain sensitivity of a liquid thermometer.
- Demonstrate various types of thermometers and explain their uses.
- Derivation of the formula: C/5 = (F-32)/9=(K-273)/5.
- Relation between different temperature scales.
- Simple numerical problems.

3.2. Thermal Expansion: 3 Hrs.

- Linear, superficial and cubical expansion of solids.
- The relations $1_2=1_1[1+ \alpha (\theta_2- \theta_1)]$, $A2=A_1 [1+\beta (\theta_2- \theta_1)]$, $V2=V_1 [1+\gamma (\theta_2- \theta_1)]$.
- Relation between coefficient of linear, superficial and cubical expansion of solids.
- Apparent and real expansion of a liquid.
- Change in density of an object due to change in temperature.
- Anomalous expansion of water and its importance to marine life.
- Use of water cooling and heating purposes.

3.3. Heat Capacity: 3 Hrs.

- Heat capacity, specific heat capacity.
- The relation between joule and calorie.
- Melting point, boiling point and freezing point of a substance.
- The effect of pressure on melting and boiling point of substance.
- Calorimetric principle.
- Latent heat of vaporization and fusion.
- Determination of latent heat of fusion of ice by the method of mixture.
- Simple numerical problems.

3.4. Hygrometry: 2 Hrs.

- Definition of saturated and unsaturated vapors.
- Definition of triple point; triple point of water.

- Definition of dew point, absolute humidity and relativity humidity.
- Explanation of dryness and dampness.
- Determination of relative humidity by wet and dry bulb hygrometer.
- Description of Air conditioning.
- Solve related numerical problems.

3.5. Transfer of heat 2 Hrs.

- The transfer of heat by conduction, convection and radiation.
- Thermal conductivity giving its dimension and units.
- Laws of black body radiation.
- Solve related numerical problems.

3.6. Gases: 6 Hrs.

- Statement of Boyle's law and Charle's law.
- Definition of absolute temperature and absolute Zero.
- Concept of ideal gas equation.
- Know the value of R.
- To state and explain Dalton's law of partial pressure.
- Derivation general formula of work done by gas.
- Definition of internal energy of gas.
- Statement of first law of thermodynamics and its draw backs.
- Definition of Molar and specific heat capacity of a gas.
- Derivation of C_p-C_v= R
- Definition of isothermal and adiabatic changes.
- Derivation of pressure exerted by a gas.
- Explanation for r.m.s. speed.
- Solve related numerical problems.

Unit 4. Modern Physics: 20 Hrs.

4.1. Electrons: 3 Hrs.

- Practical nature of electricity.
- Production and properties of cathode rays.
- Moving electrons in electric and magnetic fields.
- Specific charge of an electron.

4.2. Photo electricity: 4 Hrs.

- Photoelectric effect, quantum theory of radiation.
- Einstein's photoelectric equation $hv=\varphi+1/2mv^2$ and interpretation.
- Explanation of postulates of Bohr's theory of hydrogen atom.
- Wave nature of particle.
- Simple numerical problems.

4.3. X-rays: 2 Hrs.

- X-rays and its Properties of x-rays.
- Production and nature of x-rays.
- Various uses of x-rays. (hard and soft).
- Continuous and characteristic X-rays.
- Simple numerical problems.

4.4. Radioactivity: 4 Hrs.

- Radioactivity.
- Properties of α, β and γ radiations.
- Laws of radioactive disintegration. ($N=N_o e^{-\lambda t}$, $dN/dt = -\lambda t$)
- The constant relationship between half-life and decay.
- Concept of carbon dating.
- Agricultural uses of radiation and artificial radioactive nuclei.
- Simple numerical problems.

4.5. Properties of nucleus: 4 Hrs.

- The constitutions of nuclei.
- mass numbers of different elements and Isotopes , isobars.
- Atomic mass unit and Binding energy, Mass defect and B.E of nucleus.
- Einstein's mass energy relation.
- Fission and Fusion with energy released estimation.
- Radiation hazard and safety.

4.6. Physics and society: 3 Hrs.

- Deteriorating conditions of the environment we live in.
- Concepts of different types of pollution. (with cause and effect).
- Concepts about ozone depletion, greenhouse effect and acid rain.
- Useful and harmful aspects of radiation.
- Environmental protection strategies.

Physics Practical II (Laboratory) 30 Hrs.

(Any eight practical work out of ten should be accomplished.)

1. Determine the melting Point of given solid by cooling curve method.
2. Determine the latent heat of fusion of ice.
3. Verify Ohm's law and find specific resistance of material used in circuit by using ammeter and voltmeter.
4. To Study the current voltage characteristic of non-ohmic conductor using general diode.
5. Determine the specific resistance of given wire by using meter-bridge.
6. Verify series and parallel combination of resistance by using P.O. box.
7. Determine the internal resistance of given dry cell in its discharging mode.
8. Determine the magnetic moment and pole-strength of a given bar magnet by locating the neutral points, keeping its N-pole pointing to south and N-pole pointing to north.
9. To determine the angle of dip in the laboratory using dip circle.
10. Determine the frequency of AC mains using Sonometer.

Recommended text:

- Brij Lai and Subramanyan, Principles of physics, *A text book of physics by Satya Prakash Part I & II*
- Nelkon and parker, advanced level physics (5^{th} ed.)
- Shrestha, U. P, Physics Practical Guide
- Shrestha, V.K. Numerical examples in physics Vol. I and II Ratna Pustak Bhandar, Nepal

Reference Texts:

- Pradhan J.M. and gupta, S.K, A textbook of physics (part i and ii)
- Verma, H.C, Concepts of physics i &ii
- Sears, Zemansky & young, University physics
- Haliday, D &Resnickm R. Physics Part i &ii

Note: in case of an unavailability of above sources;

1. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject.
2. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Final written exam marking scheme

Unit	1	2	3	4	Total
Unit Hours	14	8	18	20	60
Marks	15	10	15	20	60

Chemistry II

(AG1204SH**)**

Year: I **Total: 7 hours /week**

Semester: II **Lecture: 4 hours/week**

Tutorial: 1 hour/week

Practical: hours/week

Lab: 2 hours/week

Course description:

This course is designed to give students the fundamental concept of physical, organic and in-organic chemistry. Emphasis is given to the principles related to chemistry within everyday life and to the application of chemistry in Agriculture science. An additional function of the course is to stimulate interest in the application of chemistry and to prepare the student for further study in this field. Chemistry practical acquaints the student with use of related laboratory equipment and provides practical application of learned theory, which is relevant to Forestry

Course objectives:

Upon completion of the course the students will be able to:

- Explain the basic chemical changes involved in chemistry.
- Test the soil to increase the fertility with proper treatment.
- Apply the knowledge of chemistry for the production of improved quality & hygienic food.
- Utilize chemical principles in laboratory testing.
- Explain the photo-chemical responses that occur within the body during illness.
- Apply the theoretical & practical knowledge of phyto-chemistry, which is directly involved in human life

Course Contents:

Theory

Unit 1 Physical Chemistry **7 Hrs.**

1.1: Electrochemistry

- Electrolytes, Non-electrolytes, strong and weak electrolytes
- Arrhenius theory of ionization
- Degree of ionization, Faraday's laws of electrolysis
- Electrolysis of water
- Ionic product of water, pH. pOH
- Buffer solution and mechanism of buffer action
- Importance of pH and buffer in human body

1.2: Volumetric analysis

- Equivalent and gram equivalent weight of element, acid, base, and salt
- Titration, acidimetry, alkalimetry, end point, indictor, primary standard substance
- Ways of expressing concentration of solution in terms of

  i) Normality
  ii) Molarity
  iii) Molality and %.

- Normality equations
- Calculations to prepare different concentrations of solution

Unit: 2 Inorganic Chemistry **18 Hrs.**

2.1: Water

- Soft and hard water
- The process of removal of hardness: -Boiling, Clark's process using washing soda, permutit process, soda-ash method, deionization of water
- The advantages and disadvantages of hard water
- The meaning of drinking water
- Methods of purification of drinking water by boiling, candle filtration, chemical disinfection, bleaching powder, Cl_2 solution, iodine, $KMnO_4$ ozonisation, using potash alum
- The solvent property of water

2.2.: Non-metals

- Hydrogen- physical properties, reaction with O_2, Na, Ca, X_2, N_2, vegetable oil, uses, heavy water, isotopes of hydrogen.
- Oxygen-physical properties, reaction with C, Ag, Na, H_2, SO_2, NH_3, N_2, uses.
- Carbondioxide: physical properties, reaction with Na, Mg, H_2O, lime water, carbon, iron, and uses.
- Ammonia: manufacture by haber's process. (principle with diagrammatic sketch.)
- Physical properties, chemical properties with H_2O, O_2, Na, AgCl, $CuSO_4$, nessler's reagent and uses.
    - General characteristics of halogens

2.3: Acids and chemical fertilizers

- Nitric Acid: Ostwald process. (principle with diagrammatic sketch.)
- Physical properties, acidic character, action with carbon, Sulphur, H_2S, SO_2.
- Action with $FeSO_4$, Mg, Zn, copper, ring test.
- Nitrogen cycle and causes of acid rain
- NPK fertilizer, characteristics, natural and artificial fertilizer, examples and need of NPK fertilizers.
- Role of Fertilizers in plant or vegetation
- Advantage and disadvantage of chemical fertilizer.
- Pesticide insecticide, rodenticide herbicide, fungicide and their examples.
- Sulphuric acid: contact process (no description)
- Physical properties, dehydrating action with Zn, Cu, salts, oxidising agents.
- Hydrochloric acid: physical properties, acidic nature, action with ammonia, silver nitrate, salts and uses.

2.4: Minerals

- Sources of the following minerals-Na, K, Ca, Mg, Fe, Zn, Ni, Cobalt
- Biological importance and effects due to their deficiency

2.5: Cycles and Elements

- Oxygen Cycle
- Nitrogen Cycle
    - Carbon Cycle and Water cycle

2.6: Metals

- Characteristic of metals and non-metals
- Occurrence of metals.
- General metallurgy of metals. (crushing and dressing)
- Calcination and roasting, reduction with carbon.
- Purification (distillation and electro refining)
- Sodium: physical properties, action with air, water, non-metals NH_3.
- Physical properties of copper, action with H_2SO_4, HNO_3, and short notes on bluevitrol.
- Zinc, physical properties, action with HCl, HNO_3, H_2SO_4, water, air and alkali, galvanization.
- Iron: physical properties action with HCl, HNO_3, H_2SO_4, water, halogen, rusting.

Unit: 3: Organic Chemistry **20 Hrs.**

3.1: Ether

- Lab preparation of diethylether from ethanol
- Physical properties
- Chemical Properties with Combustion, hydrolysis, reaction with HI and PCl_5
- Uses in medicine and everyday life

3.2: Carbonyl compound

Lesson A Formaldehyde & Acetaldehyde

- General methods of preparation
- Physical properties.
- Chemical properties-with ammonia, with NH_4OH, NaOH, Polymerisation.
- Uses in everyday life.

Lesson B. Acetone (Ketone)

- Preparation from isopropyl alcohol and Ca-acetate
- Physical properties
- Chemical properties with $NaHSO_3$, Phenyl hydrazine
- Uses in everyday life

3.3: Carboxylic acid Acetic Acid

- Preparation from acetylene and ethanol
- Physical properties
- Chemical properties with-$NaHSO_3$, NH_3, C_2H_5OH, PCl_5 and reduction, acidity of carboxylic acid
- Uses in everyday life
- Uses of formic acid in everyday life
- Natural sources of acetic acid

3.4: Amines.

- Nomenclature and classification of amines
- Basicity of amines
- Examples of amines

3.5: Phenol

- Preparation from benzene diazonium chloride and sodium benzene sulphonate, physical properties.
- Action with Na, Zn, NH_3, benzene diazonium chloride Kolbe's reaction.

3.6: Aromatic Compounds

- Aromatic compounds
- Nomenclature of benzene derivatives (Mono, di and tri-substituted)
- To define heterocyclic compounds.
- Characteristics of aromatic compounds
- Differences between aliphatic and aromaticlomped
- Nomenclature and examples of different aromatic compounds

3.7: Natural Products chemistry

- List of Medicinal Plants in Nepal
- Phytochemical Technique; Extraction, Isolation, Purification, and characterization of Natural products
- Introduction about alkaloids, steroids, antibiotics

Practical (Laboratory)

1. Standardize the given acid, which is approximately decinormal. 2 Hrs.
2. Determine the strength of alkali with the help of a standard acid supplied. 2 Hrs.
3. Determine the strength of acid in terms of: 2 Hrs.
    - Normality
    - Grams/liter
    - Percentage
4. To compare the hardness of different types of water 2 Hrs.
5. Identify given organic compounds 2 Hrs.
6. Describe different techniques on phytochemical screening of some medicinal plants 6 Hrs.
7. To detect the basic radicals (Cu^{++}, Al^{+++}, Fe^{+++}, Zn^{++}, CO^{++}, Ni^{++}, Ca^{++}, Ba^{++}, Mg^{++}) by wet ways 6 Hrs.
8. To detect the acid and basic radicals (complete salt analysis) 6 Hrs.

Textbooks:

1. Foundations of chemistry, Vol-2, M.K. Sthapit and R.R. Pradhananga
2. A text Book of chemistry, Jha & Guglani
3. A text Book of Organic Chemistry, B.S. Bahl & Arun Bahl
4. Elementary qualitative analysis, M.K. Sthapit and C.B. Tuladhar
5. Elementary practical chemistry, MK. Sthapit

References:

1. Inorganic chemistry, Bahl & Tuli
2. Elementary Organic Chemistry, P.N. Bargava
3. Fundamentals of chemistry, K.R. Palak
4. A text Book of Inorganic Chemistry, L.M. Mitra

Final written exam marking scheme

Unit	1	2	3	Total
Unit Hours	12	20	28	60
Marks	10	20	30	60

Zoology II

(AG1205SH**)**

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

Semester: II **Lecture: 4 hours/week**

Tutorial: hour/week

Practical: hours/week

Lab: 2 hours/week

Course description:

This basic course in zoology discusses the characteristics of unicellular and multicellular structures. The course contains relationships between organisms and environment, detailed study of the anatomy and physiology of mammals, behavior of animals in response to environment.

Practical zoology includes study of microscope, museum specimens of invertebrates and invertebrates, permanent slides of animal tissues, temporary mount, man-made ecosystems and dissection of earthworm and rat.

Course objectives:

Theory and Practical zoology course content has been designed, with the objective that

- Describe the relationships of organism with their surrounding
- Understand the environment and it's cause of degradation
- Understand the adaptation of animals according to the environment
- Understand the behavior of organisms in response to environment
- Understand conservation and its importance
- Practical zoology aims to develop skill in
    - collect and identify
    - preserve
    - dissect
    - draw figure
    - handle the equipment, instruments and laboratory handling with experimentation
    - draw conclusion

Course Contents:

Theory 60 Hrs.

Unit 1 Study of life process of mammals **14 Hrs.**

1.1 Systemic position and morphology of man.

1.2 Structure, organs and physiology of

1.2.1 Digestive system.

1.2.2 Respiratory system.

1.2.3 Circulatory system.

1.2.4 Reproductive system and

1.2.5 Excretory system

1.3 Introduction to Endocrine System- List different glands and its major role in human body

1.4 Nervous system- Basic structure and organs involved. Its major function in human body

Unit 2 Ecology and environment **23 Hrs.**

2.1 Ecosystem
- 2.1.1 Structural and functional organization of ecosystems- Components of ecosystem, Abiotic and biotic factors of ecosystem and their interrelationships.
- 2.1.2 Study the various components and its interactions in pond ecosystem and Grassland ecosystem as examples of Aquatic and Terrestrial ecosystems.
- 2.1.3 Define Food chain, trophic level and describe energy flow in an ecosystem---
  - 2.1.3.1 Concept of ecological pyramid- its types
  - 2.1.3.2 Describe the interaction between biotic factors
    - 2.1.3.2.1 Positive interactions- commensalism, mutualism, colonization, and social organization
    - 2.1.3.2.2 Negative interactions- predation, parasitism, competition and antibiosis.

2.2 Ecological imbalances and consequences
- 2.2.1 Greenhouse effect, acid rain and depletion of ozone layer
- 2.2.2 Importance of Greenhouse effect and ozone layer for life on earth.
- 2.2.3 Description of the mechanism of greenhouse effect, acid rain and depletion of the ozone layer.
- 2.2.4 Causes and consequences of greenhouse effect, depletion of ozone layer, acid rain and biological invasion.

2.3 Environmental pollution
- 2.3.1 Definition of pollution
- 2.3.2 Types of pollution- Air, water, Land/ Soil, Radioactive Pollution
- 2.3.3 Source of water pollution, their effect and preventive measures.
- 2.3.4 Source of air pollution, their effect on living organisms and preventive measures of air pollution.
- 2.3.5 Sources of soil pollution, their effects on living organisms and preventive measures of soil pollution
- 2.3.6 Sources of Radioactive pollution, their effects on living organisms and preventive measures of Radioactive pollution

Unit 3 Animal adaptation **5 Hrs.**

3.1 Meaning of adaptation
3.2 Explain the features and examples of aquatic adaptation
3.3 Explain the types and features of terrestrial adaptation with appropriate examples of- Aerial/ Volant, Desert, Arboreal, Fossorial, Cursorial

Unit 4Animal behavior **8 Hrs.**

4.1 Definition of learned behavior and inborn behavior
4.2 Definition of reflex action
4.3 Definition of taxis and its types
4.4 Definition of Leadership and the qualities of leader
4.5 Discuss common examples of leadership in animals

Unit 5 Conservation of wildlife/ Conservation Biology **10 Hrs.**

Definition of wildlife/ State the concept of biodiversity

3.4 Importance of wildlife conservation/ importance of Biodiversity to maintain viable ecosystems
3.5 Identify causes of extinction and its effect for human beings
3.6 Strategies for wildlife/ Biodiversity conservation focusing on wildlife, national parks, conservation areas, biodiversity hotspots, wetland and Ramsar sites
3.7 Explain IUCN Red list categories and discuss endangered species in Nepal.
3.8 What is Forest conservation, importance of afforestation
3.9 Causes and consequences of deforestation.

Practical

Unit 1 Dissection of animal **20 Hrs.**

1.1 Dissection of Rat
- 1.1.1 Digestive System
- 1.1.2 Respiratory System
- 1.1.3 Circulatory System
- 1.1.4 Male Reproductive System
- 1.1.5 Female Reproductive System
- 1.1.6 Endocrine System
- 1.1.7 Nervous System

Unit 2 Study of an ecosystem **10 Hrs.**

2.1 Aquatic ecosystem
- 2.1.1 Study Aquarium as a pond ecosystem
- 2.1.2 Abiotic factors of a pond.
- 2.1.3 Biotic factors of pond.
- 2.1.4 Identify food chain in aquarium
- 2.1.5 Differences in real pond and aquarium as an aquatic ecosystem.

2.2 Terrestrial ecosystem
- 2.2.1 Study Agricultural ecosystem as a terrestrial ecosystem
- 2.2.2 Abiotic factors of an agricultural land- Collect and study soil from at least two different sites and study them for texture, moisture content, pH and water holding capacity of soil. Correlate with the kinds of plants found in them.
- 2.2.3 Biotic factors of farmland.
- 2.2.4 Abiotic factors of farmland.
- 2.2.5 Identify food chain in agricultural ecosystem
- 2.2.6 Differences in real terrestrial ecosystem and agricultural ecosystem.

Recommended Text Books:

1. Ashok K Bam, Bidya Sagar Jha, Janak Raj Subedi, Rup Bahadur Shah, Dhirendra Bahadur Jha- Zoology for Agriculture with Practical, Advance Ayam Publication.
2. Keshari Arvind-*A textbook of Zoology for health sciences*, Vidyarthi Pustak Bhandar
3. Shrestha Raghubar; Ghimire Suvas Chandra- *United Zoology for health sciences*, United Nepal Publications (P.) Ltd.

4. Kotpal, R. L., *Modern Text Book of Zoology, Invertebrates*, Rastogi Publications Kotpal R. L., *Modern Text Book of Zoology, Vertebrates*, Rastogi Publications - Keshari A., *Practical Biology*, Vidyarthi Publication.
5. Verma P. S., *Practical Zoology (Invertebrate)* – S Chand and Company Pvt. Ltd.
6. Verma P. S., *Practical Zoology (Chordate)*, S Chand and Company Pvt. Ltd.
7. Sharma Subodh- *A handbook of practical zoology*, Himalaya Book Stall.
8. Labh Shyam Narayan- *A Textbook of Practical Biology*, Taleju Prakashan.
9. Keshari Arvind, Khaga Raj Ghimire, Bijay Shankar Mishra- *Practical Biology for class XI*, Vidyarthi Pustak Bhandar.

Reference Books:

1. Prof. Arvind K. Keshari- *A Textbook of Higher Secondary Biology, Vol I & Vol II* Vidyarthi Pustak Bhandar
2. Arvind K. Keshari, Khaga Raj Ghimire, Bijay Shankar Mishra & Kamal K. Adhikari- *A Textbook of Higher Secondary Biology, Class XI,* Vidyarthi Pustak Bhandar
3. Arvind K. Keshari & Adhikari, K.- *A Textbook of Higher Secondary Biology, Class XII,* Vidyarthi Pustak Bhandar
4. Vidyarthi R. D. and Pandey P. N. - *A Textbook of Zoology*, S Chand and Company Pvt. Ltd.
5. Majpuria T. C. Modern Approach to Zoology – Pradeep Publications
6. Sharma, P.D. - *Ecology and Environment*, Rastogi Publications
7. Agrawal V. K. and Gupta V. - *Ecology and Ethology*, S Chand and Company Ltd.

Final written exam marking scheme

Unit	1	2	3	4	5	Total
Unit Hours	14	23	5	8	10	60
Marks	15	25	5	5	10	60

Botany II

(AG1206PS**)**

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

Semester: II **Lecture: 4 hours/week**

Tutorial: hour/week

Practical: hours/week

Lab: 2 hours/week

Course description:

This subject consists of five units related to plant anatomy, plant physiology, embryology, genetics, biotechnology and environmental biology necessary to develop background in agricultural botany that supports for the understanding and practicing the related agricultural works.

Course objectives:

After the completion of this course, students will be able to explain the basic concepts related to the followings topics and apply them in the field of related Agricultural area.

1. plant anatomy,
2. Plant physiology,
3. Embryology
4. Genetics
5. Biotechnology
6. Environmental biology

Course Contents:

Theory

Unit 1: Plant Anatomy: **16 Hrs.**

1.1: Tissue and its types 8 Hrs.

- Define tissue
- Classify tissues as Meristematic, Permanent and Secretory
- List features of Meristematic tissues
- Give types of Meristematic tissues with examples
- Define permanent tissues
- Classify permanent tissues as simple and complex
- List basic features, distribution and function of different simple and complex permanent tissues
- Define secretory tissues
- Give types of secretary tissues, their examples and importance.
- Define primary and secondary tissues.
- List and define types of Xylem- protoxylem and metaxylem; exarch, endarch, mesarch and centrarch.
- Define vascular bundles and their elements-xylem, phloem and cambium.
- Identify types of vascular bundles- radial, conjoint (collateral, bicollateral and concentric); open and closed.

1.2: Internal structure of dicot and monocot root, stem and leaf. 6 Hrs.

- Describe internal structures of dicot and monocot stems.
- Describe internal structure of dicot and monocot roots.
- Describe internal structure of dicot (dorsiventral) leaf and monocot (isobilateral) leaf

1.3: Secondary growth 2 Hrs.

- Define secondary growth.
- Discuss the role of cambium and cork cambium in the secondary growth of dicot root and stem.
- Define annual rings and discuss how they are formed.

Unit2: Plant Physiology 15 Hrs.

2.1 Diffusion: 3 Hrs.

- Define diffusion and list its importance in living systems.
- Define concentration gradient.
- List the factors affecting diffusion.
- Define facilitated diffusion and osmosis.

2.2. Osmosis: 3 Hrs.

- Define osmosis and the terms related to osmosis- semipermeable, osmotic pressure, water potential, hypotonic and hypertonic solutions, endosmosis and exosmosis, plasmolysis and turgid and flaccid cells.
- List the significance of osmosis.
- Define active transport and give its significance.

2.3. Transpiration: 2 Hrs.

- Define transpiration.
- Define stomatal, lenticular and cuticular transpiration.
- Describe factors affecting transpiration.
- Describe the significance of transpiration.

2.4 Photosynthesis 3 Hrs.

- Define Photosynthesis.
- List some major photosynthetic pigments and identify their role, structure of chloroplast.
- Identify the sites of photosynthesis.
- List the major steps of photosynthesis.
- List the factors affecting photosynthesis.

2.5: Respiration 4 Hrs.

- Define respiration.
- Define and differentiate aerobic and anaerobic respiration.
- Identify the sites of respiration.
- List the major steps of aerobic respiration.
- List the factors affecting aerobic respiration.
- Give major steps of anaerobic respiration and fermentation.

Unit 3: Embryology of Angiosperms 10 Hrs.

3.1: Reproduction 3 Hrs.

- Define asexual reproduction
- Mention types of asexual reproduction in plant.

3.2: Pollination 3 Hrs.

- Define pollination.
- Define self and cross-pollination.

- List different types of pollination based on pollinating agent and features of flowers with such pollinations.
- Discuss merits and demerits of self and cross-pollination.
- Discuss mechanisms developed by flowering plants for cross-pollination.

3.3: Fertilization 3 Hrs.

- Define fertilization.
- Describe the structure of a typical angiosperm ovule with diagram.
- Describe the process of pollen germination, pollen tube development, double fertilization and triple fusion in angiosperms.

Unit 4: Genetics **5 Hrs.**

4.1 Heredity and Variation 2 Hrs.

- Define heredity and variation.
- Explain causes of variation like environmental causes, mutation (gene and chromosomal), polyploidy etc.
- Define somatic and genetic variation, continuous and discontinuous variations.
- Describe the significance of variation.
- Define the terms: Chromosome, gene, alleles, genotype and phenotype, homozygous and heterozygous and clone.

4.2 Mendel's Law of Inheritance 3 Hrs.

- Explain Mendel's experiments.
- List the reasons for selecting pea plant by Mendel in his experiment.
- Define monohybrid and dihybrid crosses.
- Mendel's laws: Law of dominance, Law of Segregation, law of independent assortment.

Unit 5: Biotechnology **8 Hrs.**

5.1: Introduction to Biotechnology 3 Hrs.

- Define Biotechnology.
- List the branches of Biotechnology.
- List the application of Biotechnology.

5.2: Plant Tissue Culture 3 Hrs.

- Define *in vitro* culture.
- Define cell, tissue, and organ culture.
- Define cellular totipotency.
- Define culture media.
- Tell importance of sterilization and list methods of sterilization.
- Define and summarize procedures of micropropagation and list its applications.
- List the applications of Plant Tissue Culture

5.3 Introduction to Plant Breeding 2 Hrs.

- Define plant breeding.
- List and define the methods of plant breeding (Hybridization).
- Discuss the significance of plant breeding.

Unit 6: Environmental Biology **6 Hrs.**

6.1: Ecology 2 Hrs.

- Define ecology
- List its types (autecology and synecology) and define it
- Concept of ecosystem and list major types of ecosystem.
- Components of ecosystem (biotic and abiotic) in brief.

6.2: Ecological imbalance 4 Hrs.

- Define ecological imbalance.
- Describe the types of ecological imbalance (ozone layer depletion, acid rain, pollution, green house effects)
- Describe its effect, cause, consequences of ecological imbalance relating to agriculture.
- Write its control measures in brief

Practical (Laboratory) 30 Hrs.

Practical 1: Plant Breeding

- Learn basic techniques and processes of hybridization experiments.

Practical 2: Biotechnology

- List the equipment used in tissue culture.
- Describe basic technique and processes of tissue culture.

Practical 3: Plant Anatomy

- Describe the structure and functioning of a compound microscope.
- Prepare temporary slides of dicot and monocot stems to study the anatomical structures.
- Prepare temporary slides of dorsiventral and isobilateral leaves to study the anatomical structures.
- Describe annual rings in dicot stem.

Practical 4: Physiology

- Study diffusion using copper sulphate crystals put in a beaker of water.
- Study osmosis through egg membrane or Potato osmoscope.
- Study the rate of transpiration under different environmental conditions using Ganong's potometer.
- Demonstrate experimentally that oxygen is evolved during photosynthesis. OR Demonstrate experimentally that carbon dioxide is necessary for photosynthesis.
- Demonstrate that carbon dioxide is evolved during aerobic respiration.
- Demonstrate that carbon dioxide is evolved during fermentation.

Practical 5: Embryology of Angiosperms

- Study the permanent slide of angiosperm ovule.
- Study permanent slide of a dicot embryo.

Learning materials:

1. Sinha, V. and S. Sinah. *Cytogenetics Plant Breeding and Evolution.* Vikas Publications Ltd, New Deldi.
2. Keshari, A. K. Ghimire, K. R., Mishra, B. S., and K. K. Adhikari, *A text Book of Higher Secondary Biology (Class II)* Vidyarthi Pustak Bhandar, Kathmandu.
3. Keshari, A. K. and K. K. Adhikari. *A text Book of Higher Secondary Biology (Class II).* Vidyarthi Pustak Bhandar, Kathmandu.
4. Ranjitkar, H. D. 2005. A Hand Book of Practical Botany. Mr. Arun K. Ranjitkar, Kalanki, Kathmandu.
5. Mahat, Ras Bihari, *A text book of Biology part I and Part II*
6. Lawerence, C. H. M., *Taxonomy of Vascular Plants.* McMillan Company.

7. Bhojwani S. S. and S. P. Bhatnagar. *The Embryology of Angiosperms.* Vikas Publication, Delhi, 1993.
8. Dubey, R. C. *A Textbook of Biotechnology.* S. Chand and Company Ltd, New Delhi, India.
9. Jain, V. K. *Fundamentals of Plant Physiology.* S. Chand and Company Ltd, New Delhi, India.

Other learning materials:

1. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject
2. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Final written exam marking scheme

Unit	1	2	3	4	5	6	Total
Unit Hours	16	15	10	5	8	6	60
Marks	15	15	10	5	10	5	60

Computer Application

(EG1211CT)

Year: I **Total: 4 hours /week**
Semester: II **Lecture: 2 hours/week**
Tutorial: hour/week
Practical: hours/week
Lab: 2 hours/week

Course description:
This course deals with the history of computer development, hardware components, Systems software, Application packages, Utility software, Computer networks and Internet. Students will learn classifications of computers, its architecture and software application installations, Peripheral devices installation, computer networks, internet and their use in various purposes.

Course objectives:
On completion of this course the students will be able to:
1. Explain the basic architecture of Computer;
2. Identify major components of computer and their role;
3. Be familiar with the different Operating Systems like MS-DOS, Windows etc.;
4. Use the different Software applications;
5. Apply the basic networking concept; and
6. Apply internet for different purposes.

Course Contents:

Theory

Unit 1. Introduction to Computers: **2 Hrs.**
1.1 History of computers
1.2 Generation of computer
1.3 Types of computer
1.4 Computer hardware and software

Unit 2. Hardware Components: **6 Hrs.**
2.1 Major blocks of a digital computer
2.2 Input devices: keyboard, mouse, joystick, scanner, light pen etc.
2.3 Output devices: monitor, printer, plotter, speaker etc.
2.4 Central Processing Unit
2.5 Memory Unit
- 2.5.1 Primary Memory (RAM and ROM)
- 2.5.2 Secondary Memory
  - Magnetic storage like floppy disk, hard disk, magnetic tape etc.
  - Optical storage like CD, DVD etc
  - Solid state storage like Pen drive, flash memory card etc.
- 2.5.3 Cache Memory

Unit 3. System Software: **6 Hrs.**
3.1 Importance of Operating Systems (OS)
3.2 Types of Operating System
3.3 Functions of Operating System
- 3.3.1 Memory management

3.3.2 Device management
3.3.3 File management
3.3.4 Processor management
3.3.5 Security

3.4 MS-DOS
3.4.1 System files: io.sys, msdos.sys, command.com, config.sys, autoexec.bat
3.4.2 MS-DOS internal and external commands

3.5 Windows Operating System
3.5.1 Graphical User Interface and windows environment, file/folder management

3.6 Linux: GNU open source operating system

3.7 Device driver

Unit 4. Application Packages: 7 Hrs.

4.1 Word Processing Software: Microsoft Word

4.2 Spreadsheet Software: Microsoft Excel
- Entering data
- Using formula
- Basic calculations
- Financial calculations
- Charts

4.3 Presentation Software: Microsoft PowerPoint

4.4 Concept of Database management system

4.5 Database management package: Microsoft Access

Unit 5. Utility Programs: 2 Hrs.

5.1 Computer virus and its removal (antivirus programs)

5.2 File management and backup tools

Unit 6. Networks and Internet: 7 Hrs.

6.1 Introduction and advantages of computer networks

6.2 LAN, MAN and WAN

6.3 LAN Topologies: Bus, Ring, Star, Mesh, Tree and Hybrid

6.4 Transmission media: Guided and Unguided media

6.5 Network components: Hub, Switch, NIC, Router, Bridge etc.

6.6 Network Architecture: Peer to peer and Client-server network

6.7 Hardware and file sharing

6.8 Email/Internet
- World Wide Web (WWW)
- ISP
- Search Engines
- Web browsers: Internet Explorer, Netscape Navigator, Mozilla Firefox etc.,
- Webpage and Website
- Email

Practical 30 Hrs.

Unit 1: Components of computer 10 Hrs.

1.1 Identify major components of computer.

1.2 Familiarize with keyboard and mouse.

1.3 Identify Internal and External DOS commands

1.4 Apply Windows Graphical User Interface
1.5 Manage file/folder

Unit 2: Microsoft Word **10 Hrs.**

a. Edit text
b. Format document
c. Create tables
d. Create graphics and word art

Unit 3: Microsoft Excel **15 Hrs.**

a. Edit worksheet
b. Format and manipulate data
c. Analyze data (use of functions for calculation)
d. Present charts/data
e. Import/Export data

Unit 4: Microsoft PowerPoint **10 Hrs.**

a. Create slides
b. Design and format slides
c. Add animation and control

Unit 5: Microsoft Access **10 Hrs.**

a. Create and manipulate data tables
b. Make Query
c. Prepare Form/Report
d. Use Internet/Email

Unit 6. Project Work: **5 Hrs.**

The students will be assigned (individually or in group) a project work based on Microsoft Excel/Microsoft Access. The students are required to prepare a short report in MS Word and prepare a short presentation in Power Point.

References

1. Rajaraman, "*Fundamentals of Computers*", Prentice-Hall of India
2. B Ram, "*Computer Fundamentals*", Willey Eastern Publishers
3. S Saxena, "*A First Course in Computers"*, Vikash Publishing
4. Winn Rosch, "Harware Bible"
5. Noel Kalicharan, "Introduction to computer Studies", Cambridge Low Price Edition
6. P.K Sinha, "Computer Fundamentals"

Evaluation Scheme

Unit wise Marks division for Final Exam

Units	Title	Hours	Mark distribution
1	Computer	4	6
2	Hardware Components	8	12
3	System Software	8	12
4	Application Packages	20	25
5	Utility Programs	10	15
6	Networks and Internet	10	10
	Total	**60**	**80**

Second Year/First Semester

Introduction to Animal Production Systems

(AG2102AS**)**

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

Semester: I **Lecture: 3 hours/week**

Tutorial: hour/week

Practical: 2/2 hours/week

Lab: hours/week

Course Description

This course is designed to provide the knowledge role of livestock in Nepalese agricultural systems, characterization of Livestock production systems, factors influencing the livestock production, body Parts of different domestic animals and birds, digestive and reproductive systems of livestock and poultry species, approach, handling and control and identifications of livestock and poultry, judging, dentition and ageing of animals. The course also includes importance of record keeping and different types of records and their uses and common husbandry practices in livestock and poultry farming.

Objectives:

After completion of this course students will be able to:

1. Describe the status of the livestock production and their importance in Nepalese agriculture system;
2. Identify the factors affecting livestock production and performance;
3. Explain digestive and reproductive system of animals;
4. Handle and manage the animals during different farm operations.

Course Contents

THEORY

Unit 1: Role of livestock in Nepalese agricultural systems **3 Hrs.**

1.1 Importance of livestock in agriculture, national economy and nutritional security
1.2 Livestock and its socio-economic role
1.3 Livestock and livelihoods
1.4 Livestock and the environment
1.5 Livestock as emitters of GHGs
1.6 Livestock as nutrient recyclers

Unit 2: Factors influencing the livestock production **2 Hrs.**

2.1 Bio-physical, socio-cultural and economic factors
2.2 Seasons, vegetation, land quality and tenure policies
2.3 Disease and parasites
2.4 Market
2.5 Government policies

Unit 3: Characterization of livestock production systems **7 Hrs.**

3.1 Extensive systems: (low input - low to moderate output)
- 3.1.1 Review of livestock production system in Nepal
- 3.1.2 Characteristics of extensive farming
- 3.1.3 Pastoralism

3.1.4 Subsistence farming
3.1.5 Ranching

3.2 Intensive systems: (High input - high output farming)
3.2.1 Characteristics of intensive farming
3.2.2 Environmental issues in intensive farming

3.3 Characteristics of Semi Intensive livestock farming system
3.4 Crop livestock production systems
3.5 Land less livestock production system
3.6 Smallholder livestock production system
3.7 Advantages and Disadvantages of different farming systems

Unit 4: Introductory animal husbandry 7 Hrs.

4.1 Taxonomic classification of animals and the arrangement of common domestic livestock
4.2 Definition of livestock and livestock management, history of farm animal domestication and behavior of farm animals.
4.3 Breeds breed availability and their performance in Nepalese context
4.4 Effect of climate on animals
4.5 Common terms in livestock production and husbandry practices, common names for the sexes, young, groups and birthing of various animals, gestation periods of various animals, rectal temperatures and reproductive cycles

Unit 5: Body parts of different domestic animals and judging 3 Hrs.

5.1 Ruminants (cattle, buffalo, sheep and goat)
5.2 Non-ruminants (swine, horse and rabbit)
5.3 Poultry species (chicken, duck, turkey, quail, pheasant)

Unit 6: General concept on digestive and reproductive systems of livestock and poultry species 7 Hrs.

6.1 Ruminants (cattle, buffalo, sheep and goat)
6.2 Non-ruminants (swine, horse and rabbit)
6.3 Different poultry species (chicken, duck, turkey, quail, pheasant)

Unit 7: Approach to animals and their handling, control and identifications 6 Hrs.

7.1 Ruminants (cattle, buffalo, sheep and goat)
7.2 Non-ruminants (swine, horse and rabbit)
7.3 Different poultry species

Unit 8: Dentition and ageing of animals 3 Hrs.

8.1 Ruminants (cattle, buffalo, sheep and goat)
8.2 Non-ruminants (swine, horse and rabbit)

Unit 9: Importance of record keeping, different types of farm records and their uses

3 Hrs.

9.1 General management
9.2 Production

9.3 Reproduction
9.4 Financial record

Unit 10: Elementary concepts on common animal husbandry practices in livestock and poultry farming 4 Hrs.

10.1 Ruminants
10.2 Non-Ruminants
10.3 Poultry

Practical

Unit 1:	Identify the scope of animals reared under Nepalese livestock husbandry practices	1 Hr.
Unit 2:	Identify types of farming systems in Nepal	1 Hr.
Unit 3:	Identify common cattle breeds and their characteristics	1 Hr.
Unit 4:	Identify common buffalo breeds and their characteristics	1 Hr.
Unit 5:	Identify common goat breeds and their characteristics	1 Hr.
Unit 6:	Identify common sheep breeds and their characteristics	1 Hr.
Unit 7:	Identify common poultry breeds and their characteristics	1 Hr.
Unit 8:	Study body parts of domestic animals and perform judging	1 Hr.
Unit 9:	Study digestive and reproductive systems of livestock and poultry species	2 Hrs.
Unit 10:	Demonstrate different methods of livestock identifications	1 Hr.
Unit 11:	Perform approach, handling and control of Livestock	2 Hrs.
Unit 12:	Estimate age by dentition method	1 Hr.
Unit 13:	Identify the importance and methods of farm record	1 Hr.

Reference Books:

1. Banerjee, G.C. (2018). A Text Book of Animal Husbandry, Eight Edition, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, India.
2. Sastry, N.S.R. and C. K. Thomas (2005). Livestock Production Management. Fourth and Enlarged Edition, Kalyani Publishers, India.
3. Mishra, O. P. (2016). Text Book of Veterinary Sciences & Animal Husbandry for Diploma Courses, Write and Print Publications, India
4. Mathialagan, P. (2016). Textbook of Animal Husbandry & Livestock Extension, Third Revised and Enlarged Edition, International Book Distribution Co., India.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	Total
Unit Hours	3	2	7	7	3	7	6	3	3	4	45
Marks	5	5	15	15	5	15	5	5	5	5	80

Introductory Animal Nutrition

(AG2103AS**)**

Year: II **Total: 5 hours /week**
Semester: I **Lecture: 3 hours/week**
Tutorial: hour/week
Practical: 2 hours/week
Lab: hours/week

Course Description

This course is designed to provide basic knowledge about the science of nutrition which can be defined as the sum of different biochemical and physiological processes which transform food/feed components into body elements that are required for sustaining life, growth, health, and productivity. In farm animals such as livestock, pigs and poultry, nutrition is also important in maintaining food (e.g. meat, milk, eggs) product quality, minimizing the cost of production, and loss of undigested nutrients. Therefore, an understanding of basic nutrition concepts is essential for formulating rations and developing feeding practices for enhancing efficiency of food production while protecting the environment and maintaining the nutritional value of animal-derived foods.

Course Objectives

After completion of this course students will be able to:

1. Explain the importance of different nutrients for growth;
2. Explain the biochemical and physiological process of food/feed;
3. Explain feed requirement for different livestock species;
4. Able to formulate feed.

Course Contents

Theory (45 Hours)

Unit 1: Introduction **10 Hrs.**

1.1 Explain the importance of Animal Nutrition.
1.2 Importance of nutrients in health and reproduction
1.3 Nutritional terms and their definitions
1.4 Composition of plant and animal cells.

Unit 2: Feedstuffs **8 Hrs.**

2.1 Classification of feedstuffs
  2.1.1 Concentrate
  2.1.2 Energy source
  2.1.3 Protein source
  2.1.4 Roughages (green and dry)
2.2 Importance and use of unconventional feedstuffs

Unit 3: Nutrients **6 Hrs.**

3.1 Water
3.2 Carbohydrate
3.3 Lipids (Fat and Oil)
  3.3.1 Essential fatty acid
3.4 Protein
  3.4.1 Essential amino acids

3.4.2 Non- essential amino acids

Unit 4: Minerals and Vitamins **10 Hrs.**

4.1 Classification of minerals
- 4.1.1 Macro Minerals: Ca, P, K, Na, Cl, S, Mg
- 4.1.2 Micro Minerals: Mn, Cu, Zn, Se, I, Fe

4.2 Classification of vitamins and minerals
- 4.2.1 Fat soluble vitamins: Vit. A, D, E and K
- 4.2.2 Water soluble vitamins: B-complex and Vit C

4.3 Dietary sources of vitamins and minerals
4.4 Function of vitamins and minerals
4.5 Vitamins and minerals deficiency symptoms

Unit 5: Nutritional Requirement **7 Hrs.**

5.1 Cattle
5.2 Sheep and Goat
5.3 Pigs
5.4 Horses
5.5 Poultry
5.6 Fish

Unit 6: Ration formulation **4 Hrs.**

6.1 Balanced ration
6.2 Factors affecting the nutrient requirements
6.3 Methods of feed formulation

Practical

Unit 1: Identify of common feed ingredients **5 Hrs.**

1.1 Identify different feed ingredients
1.2 Differentiate and classify feed ingredients according to their nutritive value.

Unit 2: Analyze nutrient of feeds **12 Hrs.**

2.1 Proximate analysis
2.2 Crude protein
2.3 Crude fiber
2.4 Ether extract
2.5 Ash
2.6 Nitrogen free extract
2.7 Moisture

Unit 3: Calculate feed / ration formulation **5 Hrs.**

3.1 Quadratic equation
3.2 Hit and trial method

Unit 4: Inspect and evaluate feed quality **8 Hrs.**

4.1 Observational visits
4.2 Feed Industries
4.3 Agro Vets
4.4 Farms (poultry/cattle/buffalo/pig/goat etc.)

Textbooks and References

1. Verma,. D.N., (2016). Text book of Animal Nutrition. Kalyani Publishers, India.
2. Ranjhan.S.K., (2001)., Animal Nutrition in the Tropics. S. Chand (G/L) & Company Ltd. India.
3. Reddy, D.V.,)2001). Principal of Animal Nutrition & Feed Technology. Third Edition. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, India.
4. Banerjee, G.C. (2018). A text book Animal Nutrition, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, India.

Final written exam marking scheme

Unit	1	2	3	4	5	6	Total
Unit Hours	10	8	6	10	7	4	45
Marks	20	15	10	20	10	5	80

Introduction to Animal Production and Management - I
(Ruminants: Cattle, Buffalo, Yak, Sheep and Goat)

(AG2104AS**)**

Year: II **Total: 6 hours /week**
Semester: I **Lecture: 4 hours/week**
Tutorial: hour/week
Practical: 2 hours/week
Lab: hours/week

Course Description

This course is designed to provide knowledge on importance, scope and challenges of livestock production. It includes terminologies and classification of common domestic animals. It includes management practices of ruminants. The course includes housing, feeding, breeding management and other general farm operation of various stages of cattle, buffalo, sheep, goat and yak. The course covers organs related & physiology of digestion in ruminants, commonly grown fodder trees and their role in livestock feeding, ration formulation and feeding for different age group of livestock, Common Indigenous and Exotic breed of cattle, buffalo, sheep, goat and yak found in Nepal.

Course Objectives

After completion of this course students will be able to:

1. Explain the scope and importance of ruminants production and management;
2. Describe about modern farming system;
3. Identify different breed of cattle, buffalo, sheep, goat and yak;
4. Explain feeding, breeding, housing requirement of cattle, buffalo, sheep, goat and yak;
5. Commence and run livestock farm with minimum guidance from experts;
6. Generate ideas of self-employment by animal rearing.

Course Contents

Theory

Unit 1: Introduction to Ruminant **3 Hrs.**

1.1 Common Terminologies related to ruminant production
1.2 Zoological Classification of Cattle, buffalo, sheep, goat and yak
1.3 Scope, Importance & Challenges of ruminants farming in Nepal
1.4 Ruminants population, Distribution and its contribution to GDP
1.5 Inter relationship of ruminant with other branches of Agriculture
1.6 Difference between ruminants & non-ruminants

Unit 2: Breeds of cattle, buffalo, sheep, goat and yak **8 Hrs.**

2.1 Indigenous breed of Cattle, buffalo, sheep, goat and yak
2.2 Exotic breeds of Cattle, buffalo, sheep, goat and yak
2.3 National breeding policy of ruminants

Unit 3: Feeding management **10 Hrs.**

3.1 Importance of Roughages in Ruminant Production
3.2 Feeding of cattle, buffalo, sheep, goat and yak
3.3 Fodder/forage-based farming for profitability
3.4 Ration Formulation and feeding for different age group

3.5 TMR: Definition, Uses & Preparation
3.6 Fodder calendar for year round supply of green forage
3.7 Cultivation practices of common legume & Non legume forage
3.8 Cultivation practices of common legume & Non legume fodder

Unit 4: Breeding & Artificial Insemination **8 Hrs.**

4.1 Definition, uses and recent advancement of animal breeding
4.2 System of Breeding
4.3 Methods of Selection
4.4 Mechanism of Reproduction
4.5 Hormones & Their roles in reproduction
4.6 The sexual cycle, Heat detection methods
4.7 Artificial insemination: definition, Importance & Challenges in our context
4.8 Rectal palpation method for pregnancy diagnosis

Unit 5: Housing Management **6 Hrs.**

5.1 Housing for ruminant species
5.2 Small (less than 50), Medium (50-100), Large Scale (More than 100 Milking cows)
5.3 Tie stall & Loose housing system
5.4 Space Requirement for Different age and stage group of cattle, buffalo, sheep, goat and yak
5.5 Low-cost housing using locally available materials

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

6.1 Care & Management of Pregnant & Lactating Animals
6.2 Care & Management of Newly born calf, heifers, breeding bull & Sick animals
6.3 Sanitation of dairy barn & equipment
6.4 Identification: Importance & Methods used
6.5 Drenching: Uses, Importance & Methods

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

7.1 Common infectious diseases of cattle, buffalo, sheep, goat and yak
7.2 Common non-infectious diseases of cattle, buffalo, sheep, goat and yak
7.3 Vaccination for disease control

Unit 8: Selection and economics of cattle, buffalo, sheep, goat and yak farming 5 Hrs.

8.1 Selection for different purpose
8.2 Body Condition Scoring
8.3 Record keeping in commercial dairy farm
8.4 Cost of Production of milk
8.5 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 & Methods
9.4 Farm Record Keeping
9.5 Body Weight Calculation for different farm animals
9.6 Ageing by dentition
9.7 Shearing

Practical

Unit 1: Identification of indigenous breeds of cattle, buffalo, sheep, goat and yak	3 Hrs.
Unit 2: Identification of exotic breeds of cattle, buffalo, sheep, goat and yak	3 Hrs.
Unit 3: Tagging of farm animals	3 Hrs.
Unit 4: Disbudding on newly born calf	2 Hrs.
Unit 5: Live body weight calculation using formula in cow	2 Hrs.
Unit 6: Ration Formulation for different age group	3 Hrs.
Unit 7: TMR preparation for milking animal	2 Hrs.
Unit 8: Drenching practices	3 Hrs.
Unit 9: Treatment for ecto parasite	2 Hrs.
Unit 10: Castration practices in cattle and goat	3 Hrs.
Unit 11: Shearing of sheep	2 Hrs.
Unit 12: Body scoring	2 Hrs.

Reference Books:

1. Sastry, N.S.R., & Thomas, C.K. (1976). *Livestock production management* (4th ed., 2005). Kalyani Publishers, India.
2. Banerjee, G.C. (1964). *A textbook of animal husbandry* (8th ed.). Oxford and IBH Publishing Pvt. Ltd., New Delhi, India.
3. Prasad, J. (2016). *Animal husbandry and dairy Science* (6th ed.). Kalyani Publishers, New Delhi India.
4. Dhital, B. & Adhikari, M., 2016. Principle and Practices of Livestock Production and Management. First edition. Buddha Publication, Anam Nagar, Kathmandu.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	Total
Unit Hours	3	8	10	8	6	6	10	5	4	60
Marks	5	10	15	15	5	5	15	5	5	80

Basics of Fodder Production and Pasture Management

(AG2105AS)

Year: II **Total: 5 hours /week**
Semester: I **Lecture: 3 hours/week**
Tutorial: hour/week
Practical: 2 hours/week
Lab: hours/week

Course Description

This course is designed to provide knowledge about fodder and pasture management practices, classification of different types of fodder, grassland management, agronomical practices of different types of fodder grasses, conservation of green forages, alternative feeding resources in use, agro-forestry, silvi-pastoral system and its importance, common pasture species and cultivars, pasture establishment.

Course Objectives

After completion of this course students will be able to:

1. Explain about management practices of fodder and pasture;
2. Utilize alternative feeding resources;
3. Identify common pasture species and cultivars.

Course Contents

Theory

Unit1: Importance of Fodders and Grassland in Livestock Production **2 Hrs.**

Unit 2: Fodder and its classification **2 Hrs.**

Unit 3: Grassland, types of Grassland and management techniques **3 Hrs.**

Unit 4: Agronomical Practices for production of grass fodders **10 Hrs.**

4. 1 Annual
4. 2 Perennial
4. 3 Legume
4. 4 Non-legume
4. 5 Cereal crops

Unit 5: Conservation of green forages **6 Hrs.**

5. 1 Introduction need and scope of forage/fodder conservation
5. 2 Hay making
5. 3 Silage making: different methods of silage making.

Unit 6: Alternative feeding resources in use and practices **4 Hrs.**

6. 1 Conventional
6. 2 Unconventional

Unit 7: Agro forestry, Silvi-Pastoral system and its importance **6 Hrs.**

7. 1 Definition and importance

Unit 8: Common pasture species and cultivars **6 Hrs.**

Unit 9: Pasture establishment **6 Hrs.**

9. 1 Seed quality
9. 2 Sowing
9. 3 Soil environment
9. 4 Cultivated seed beds
9. 5 Management of pasture

Practical

Unit 1: Visit to fodder farms **3 Hrs.**

Unit 2: Identify fodder crops, grasses, legume and tree fodder **3 Hrs.**

Unit 3: Prepare sample of forage grasses and tree fodder for proximate analysis 2 Hrs.

3. 1 DM
3. 2 Crude fiber
3. 3 Crude protein

Unit 4: Agronomical Practices of **6 Hrs.**

4. 1 Annual
4. 2 Perennial
4. 3 Legume
4. 4 Non-legume
4. 5 Cereal crops

Unit 5: Perform treatments of straw **4 Hrs.**

Unit 6: Prepare hay and silage **4 Hrs.**

Unit 7: Prepare herbarium sheet **4 Hrs.**

Unit 8: Prepare fodder tree saplings and do plantation and management **4 Hrs.**

Reference Books:

1. Ranjhan.S.K.,(2001)., Animal Nutrition in the Tropics. S. Chand (G/L) & Company Ltd. India.
2. Banerjee, G.C. (2018). A text book Animal Nutrition, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, India.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	Total
Unit Hours	2	2	3	10	6	4	6	6	6	45
Marks	5	5	5	20	10	5	10	10	10	80

Basic Livestock Health Management - I

(AG2106AS)

Year: II **Total: 9 hours /week**
Semester: I **Lecture: 5 hours/week**
Tutorial: hour/week
Practical: 4 hours/week
Lab: hours/week

Course Description

This course is designed to provide the knowledge on gross anatomy of skeletal, digestive, respiratory, circulatory, reproductive, urinary, nervous, and endocrine system. The course includes functions of different systems of livestock and poultry, reproductive hormones and their functions. It also covers organisms causing infectious diseases: bacteria, virus, fungus, helminths, common external and internal parasites, common protozoa, administration of drugs, factors affecting drugs, understanding of drug prescription, and poisoning, inflammatory status of stomach, intestine, liver, kidney, lung, heart and mammary gland. The course include history taking and clinical examinations, diagnosis and treatment of common diseases of digestive, respiratory, excretory, nervous and integumentary system, wound, injury, fracture, anestrous, prolapse and dystocia.

Course Objectives

After completion of this course students will be able to:

1. Explain the gross structure of different systems of body;
2. Explain the physiology of digestion, absorption, reproduction and excretion;
3. Explain morphology and colony characteristics of bacteria;
4. Explain about Helminths parasites;
5. Explain drug acting on various body systems and drug prescription;
6. Diagnose and treat common diseases of digestive, respiratory, excretory, nervous and integumentary system;
7. Identify general surgical conditions;
8. Identify the diseases during gestation period.

Course Contents

Theory

Unit 1: Anatomy of Domestic animals **10 Hrs.**

1.1 Differentiate tissues of animal body
1.2 Gross anatomy of skeletal, digestive, respiratory, circulatory, reproductive, urinary, nervous, endocrine system

Unit: 2 Physiology of domesticated animals **8 Hrs.**

2.1 Animal cell: structure and functions
2.2 Functions of different systems of livestock and poultry
2.3 Reproductive hormones and their functions

Unit 3: General Veterinary Medicine **7 Hrs.**

3.1 Definitions and terminology
3.2 Inflammation definition and causes
3.3 Disease status of stomach, intestine, liver, kidney, lung, heart and mammary gland

Unit 4: Veterinary Microbiology **6 Hrs.**

4.1 Organisms causing infectious diseases: bacteria, virus and fungus.
4.2 Differentiate between bacteria and virus
4.3 Vaccine and vaccination
4.4 Immunity and immunization

Unit 5: Veterinary Parasitology **10 Hrs.**

5.1 Common internal parasites their characteristics and control measures
5.2 Common external parasites their characteristics and control measures
5.3 Common protozoa and their characteristics and control measures

Unit 6: Veterinary Pharmacology **12 Hrs.**

6.1 Route of drugs/medicines administration
6.2 Antibiotics, anthelmintics, purgatives, anti-histaminics, analgesics and anaesthetic drugs.
6.3 Factors affecting dosage of drugs
6.4 Calculating dosage of drugs
6.5 Understanding of Prescription
6.6 Poisoning: cyanide, nitrate, organophosphate, snake bite
6.7 Preparation of tincture, lotion, ointment and mixtures

Unit 7: Veterinary Internal Medicine **12 Hrs.**

7.1 Sign of health and disease
7.2 Classification of disease
7.3 History taking and clinical examination
7.4 Tympany, impaction, vomition, diarrhea and dysentery
7.5 Epistaxis and pneumonia
7.6 Anaemia
7.7 Nephritis and retention of urine
7.8 Encephalitis
7.9 Conjunctivitis and ootitis
7.10 Dermatitis

Unit 8: Veterinary Surgery **4 Hrs.**

8.1 Wounds/injuries
8.2 Burns
8.3 Dislocation and fracture
8.4 Euthanasia

Unit 9: Veterinary Reproductive problems **6 Hrs.**

9.1 Infertility /anoestrous
9.2 Metritis and retention of placenta
9.3 Prolapse
9.4 Dystocia

Practical:

Practical 1: Dissect and study entire body system in livestock and poultry 4 Hrs.
Practical 2: Collect blood collection and prepare smears 4 Hrs.
Practical 4: prepare common laboratory media 4 Hrs.
Practical 5: Demonstrate media preparation and culture of the bacterial milk samples 4 Hrs.
Practical 6: Demonstrate bacteria using Gram's Method of staining 4 Hrs.

Practical 7: Sterilize glassware utensils 4 Hrs.
Practical 9: Study parasitic eggs 4 Hrs.
Practical 10: Prepare ointments and lotions 4 Hrs.
Practical 11: Prepare route of administration of drugs 4 Hrs.
Practical 12: Prepare route of administration of vaccines 4 Hrs.
Practical 13: Paraphrase history and perform clinical examination of patient 4 Hrs.
Practical 14: Physical examination: Temperature, pulse, respiration, palpation, percussion and auscultation 4 Hrs.
Practical 15: Examine wounds and perform treatment 4 Hrs.

Reference Books:

1. Dhakal, I.P., Singh, S., & Lyon, R. (2020). *Preventive veterinary medicine: A textbook of infectious diseases of cattle, buffalo, horse, sheep, goat, swine, dog and cat* (1st ed.). ISBN 9789937075633.
2. Chakrabarti, A. (2007). *A textbook of preventive veterinary medicine*. Kalyani Publishers, India.
3. Sharma, R.D., Kumar, M., & Sharma, M.C. (2013). *Textbook of preventive veterinary medicine and epidemiology*. Indian Council of Agriculture Research (ICAR), India.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	Total
Unit Hours	10	8	7	6	10	12	12	4	6	75
Marks	10	10	5	5	10	15	15	5	5	80

Basics of Animal Product Technology- I

(Dairy and Eggs)

(AG2107AS**)**

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

Semester: I **Lecture: 3 hours/week**

Tutorial: hour/week

Practical: 2 hours/week

Lab: hours/week

Course Description

This course is designed to provide knowledge of scope and status of dairy sector in Nepal. The course includes definition of milk, diagrammatic representation of milk constituents, composition and nutritive value of milk, physical and chemical properties of milk, factors affecting the composition of milk, clean milk production and its importance cleaning and sanitation of dairy equipment. The course covers structure of mammary gland and physiology of letdown of milk, hand milking and machine milking methods, flavor defects in milk, types of microorganisms found in milk, sources of contamination and significance in dairy industry, milk purchasing, collection system, preservation and buying of milk from producers and venders, receiving, weighing and sampling of milk. The course also covers different platform and routine tests, straining, filtration and clarification of milk, milk cooling system in Nepal, milk homogenization and emulsification, milk heating system, packaging, storage and distribution in Nepal, concept of toning and standardization of milk, product diversification of dairy and its importance in Nepal. Also, the course aims to provide knowledge of egg handling and storage, egg preservation and product diversification of eggs.

Course Objectives

After completion of this course students will be able to:

1. Explain different technicalities of milk and milk products, its preservation and diversification;
2. Explain different technicalities of eggs, its nutritive value, preservation and diversification;
3. Prepare dairy products by processing milk.

Course Contents

Theory

Unit 1: Dairying in Nepal **2 Hrs.**

1.1 Dairying situation in Nepal

1.2 Meaning of dairy, dairy science and dairy technology, branches o and scope of dairy science in Nepal

1.3 Per capita consumption of milk in Nepal and abroad

Unit 2: Milk and its properties

5 Hrs.

2.1. Definition of milk and diagrammatic representation of milk constituents

2.2. Nutritive value of milk in brief

2.3. Composition of fat, proteins, carbohydrates, enzymes, vitamins and minerals of milk
2.4. Physical and chemical properties of milk in brief
2.5. Factors affecting the composition of milk

Unit 3: Anatomy and Physiology of Mammary gland **3 Hrs.**

3.1 Anatomical structure of mammary gland with figures
3.2 Physiology of letdown of milk from udder
3.3 Hormonal control of mammary gland in brief

Unit 4: Clean milk production **3 Hrs.**

4.1 Definition of clean milk and its importance
4.2 Sources of contamination of milk at dairy farm
4.3 Method of hand milking and machine milking in brief
4.4 Cleaning and sanitation of dairy barn, equipment and machines
4.5 Flavor defects and their causes and prevention

Unit 5: Microbiology of Milk **4 Hrs.**

5.1 Microorganisms (bacteria, fungus, molds, viruses etc.) found in milk.
5.2 Deteriorating types of microorganisms found in milk and milk products
5.3 Sources of contamination, uses and significance in dairy industry.

Unit 6: Buying and collection of milk **4 Hrs.**

6.1 Concept of milk cooperatives and their importance
6.2 Purchasing methods of milk on the basis of weight, volume, fat, SNF, TS, two axis test and premium
6.3 Buying and collection of milk through milk producers and venders

Unit 7: Processing of raw milk **6 Hrs.**

7.1 Receiving, weighing and sampling of milk
7.2 Platform and routine tests of milk
7.3 Straining and filtration of milk in brief
7.4 Milk cooling methods and their importance
7.5 Milk Pasteurization, Milk homogenization & emulsification and their importance
7.6 Heating system of milk
7.7 Concept of toning and standardization of milk in brief
7.8 Milk packaging, distribution and storage of milk at dairy processing unit

Unit 8: Study of Separated & Fermented milk products e.g., Ghee Butter & Yoghurt in lab **4 Hrs.**

8.1 Importance of milk product and its nutritive value
8.2 Prepare flow diagram of methods of Ghee, Butter and Yoghurt making
8.3 Explain the flow diagram of all above products separately in brief

Unit 9: Study of Coagulated& Concentrated milk products e.g., Chhana, Paneer, Chhurpi, Cheese, Khoa, Milk based, Khoa based and Dahi based products & Ice-cream in lab **6 Hrs.**

9.1 Importance of milk product and its nutritive value
9.2 Prepare flow diagram of methods of Chhana, Paneer, Chhurpi, Cheese, Khoa & Ice cream making
9.3 Explain the flow diagram of all above products separately in brief

Unit 10: Study of legal standard and specifications of dairy products 2 Hrs.

10.1 Check dairy products available in local market and note down its specifications

10.2 Make chart of legal standard and specification of dairy products given by Govt. of Nepal

Unit 11: Knowing eggs and its nutritive aspects 3 Hrs.

11.1. Process of egg formation, nutritive value of egg

11.2. Collection, handling, and storage of egg

11.3. Preservation techniques of egg

Unit 12: Utilization of egg as human food 3 Hrs.

12.1. Food processing of eggs

12.2. Product diversification of eggs

Practical

Unit 1: Identify commonly used dairy equipment and milk products in lab 2 Hrs.

1.1 Identify commonly used dairy equipment in lab

1.2 Study of commonly available dairy products in local market

Unit 2: Perform milking under hygienic condition 2 Hrs.

2.1 Cleaning and sanitation of udder and preparation of animal for milking

2.2 Practices of hand milking in dairy farm

2.3 Storage of milk safely at low temperature in dairy farm

Unit 3: Perform test of COB, Alcohol tests and MBR test 2 Hrs.

3.1 Perform COB test and Alcohol test for checking heat stability of milk

3.2 Perform MBR test for assessing the microbiological quality of milk

Unit 4: Estimate fat by Gerber's method and acidity by titration 4 Hrs.

5.1 Perform the method of fat determination, using milk Butyrometer and acidity % by titration

5.2 Familiar with the principles of fat separation and acid determination of milk

Unit 5: Estimate Sp. Gr., SNF and TS percentage of milk 2 Hrs.

5.1 Perform the methods of determination of Sp.gr., SNF, and TS using Lactometer

5.2 Use of standard formula for determination of these tests, Calibration of Thermometer,

5.3 Lactometer, Butyrometer, Milk pipette

5.4 Familiar with meniscus correction for correct reading

Unit 6: Perform cream separation and assembling 2 Hrs.

6.1 Separate all parts of cream separator for identification and function

6.2 Know the methods of assembling parts and process of cream separation

6.3 Measure the quantity of cream and skim milk

6.4 Estimation of recovery percent

Unit 7: Prepare Ghee Butter and Yoghurt in lab 4 Hrs.

1.1 Prepare flow diagram of methods of Ghee, Butter &Yoghurt making

1.2 Prepare a good quality of Ghee, Butter &Yoghurt, using flow diagram and necessary ingredients

1.3 Calculate recovery percent and evaluate the product by sensory evaluation

Unit 8: Prepare Chhana, Paneer, Churpi, Cheese, Khoa and Ice-cream in lab 6 Hrs.

8.1 Prepare flow diagram of methods of Chhana, Paneer, Chhurpi, Cheese, Khoa and Ice cream making

8.2 Prepare a good quality Chhana, Paneer, Chhurpi, Cheese, Khoa and Ice cream making, using flow diagram and necessary ingredients

8.3 Calculate recovery percent and evaluate the product by sensory evaluation

Unit 9: Prepare skim milk Powder 2 Hrs.

9.1. Prepare flow diagram of SMP preparation

9.2. Study SMP making, using different methods of powder milk preparation

9.3. Calculate recovery percent and evaluate the product by sensory evaluation

Unit 10: Perform milk adulteration tests 2 Hrs.

10.1 Prepare milk adulteration chart or table

10.2 Preform milk adulteration tests, using adulteration kit

Unit 11: Visit a dairy plant 2 Hrs.

11.1. Arrange educational trip to visit dairy processing plant near by institute

11.2. Make 2-4 groups and observe different processing units of dairy plant

11.3. Prepare a good report of dairy plant visit and submit to the class teacher

Reference Books:

1. Banerjee, G.C. (2015). *A text book of animal husbandry* (8th ed.). Oxford and IBH Publishing, New Delhi, India.
2. Clarence, H.E., Combs, W.B., & Macy, H. (1994). *Milk and milk products*. TATA, McGraw-Hill Publishing Company Ltd., India.
3. Prasad, J. (2016). *Animal husbandry and dairy science* (6^{th} ed.). Kalyani Publishers, New Delhi India.
4. Sukumar, D. (2000). *Outlines of dairy technology*. Oxford University Press, New Delhi, India.
5. Chandan, R.C. & Arun, K. (2013). *Manufacturing yoghurt and fermented milk* (2^{nd} ed.). Willey-Blackwell Publication, USA.
6. Jelen, P.V., & Sah, N. (1990). *Laboratory manual of dairy science.* IAAS, Central Campus Rampur, Chitwan, Nepal.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	12	Total
Unit Hours	2	5	3	3	4	4	6	4	6	2	3	3	45
Marks	5	5	5	5	5	5	15	5	15	5	5	5	80

Introductory Genetics and Animal Breeding

(AG2108AS)

Year: II **Total: 5 hours /week**
Semester: I **Lecture: 3 hours/week**
Tutorial: hour/week
Practical: 2 hours/week
Lab: hours/week

Course Description

This course is designed to provide knowledge on introduction to basic application of genetics and animal breeding, its importance, breeds and their status, principles of conservation and their utilization. The course covers the principles and Practices of selection, livestock breeding systems, breeding strategies, biotechnological tools in the livestock breeding systems, estimations of genetic parameters like; heritability, repeatability, MPPA, genetic gain, inbreeding coefficient, coefficient of relationship, heterosis etc, formulation of breeding plans of different livestock species.

Course Objectives

After studying this course, students will be able to:

1. Explain about the basics of animal genetics and breeding;
2. Explain the relevance different breeding strategies in farm animals to enhance the productivity of livestock species and the application of the different breeding tools;
3. Explain basics of genetic principles, livestock breeding and breeding system along with the biotechnological approaches applied in the livestock breeding systems;
4. Manage livestock breeding programs.

Course Contents

Theory

Unit 1: Introduction **4 Hrs.**

1.1 Importance of animal breeding in livestock improvement in Nepal
1.2 History of animal breeding and breeding activities and institutions in Nepal
1.3 Common terminologies in genetics and animal breeding

Unit 2: Breeds, their conservation and utilization **3 Hrs.**

2.1 Animal genetic resources of Nepal
2.2 Principles of conservation and utilization of animal genetic resources

Unit 3: Mendelian Genetics **2 Hrs.**

3.1 Basic principles of Mendelian Genetics
3.2 Deviations in Mendelian ratios

Unit 4: Chromosomes and Genes **4 Hrs.**

4.1 Chromosomal theory of inheritance
4.2 Genes and gene actions
4.3 Expression of genes in their phenotypes

Unit 5: Traits of economic importance **2 Hrs.**

5.1 Trait definition and its importance
5.2 Economic values of trait and its selection in different livestock species

Unit 6: Principles of selection **5 Hrs.**

6.1 Importance and basic principles of selection
6.2 Basis of selection
6.3 Methods of selection

Unit 7: Estimations of basic statistical and selection parameters **7 Hrs.**

7.1 Heritability, realized heritability and repeatability

7.2 Genetic gain, selection differential MPPA, selection limit, selection intensity, heterosis

7.3 Mean, variance, correlations and regressions

Unit 8: Mating Systems **6 Hrs.**

8.1 Basic principles of mating systems in different livestock species

8.2 Different types of mating systems followed in genetic improvement programs

Unit 9: Breeding Strategies **9 Hrs.**

9.1 Define breeding goal and objectives and their basis

9.2 Open Nucleus and Close nucleus Breeding Systems

9.3 Formulation of Breeding Plans for Different Livestock Species

9.4 Community Breeding Systems

Unit 10: Introduction to Bio-Technological Approaches in Animal Breeding **3 Hrs.**

10.1 Importance and methods of Artificial Insemination (AI) Embryo Transfer (ET) in livestock development

10.2 Other recently advanced Assisted Reproduction Technologies (ART).

Practical

Unit 1: Observe cell and cell division	3 Hrs.
Unit 2: Observe DNA structure, DNA replication, transcription and Translation	3 Hrs.
Unit 3: Calculate linkage map, coincidence, interference	3 Hrs.
Unit 4: Calculate gene and genotypic frequency: complete dominant, sex linked gene, multiple genes, selection, mutation, migration	4 Hrs.
Unit 5: Identify variation and causes of variation	3 Hrs.
Unit 6: Estimate selection response, selection limit, selection differential, genetic gain	4 Hrs.
Unit 7: Estimate repeatability and heritability	3 Hrs.
Unit 8: Estimate selection parameters	3 Hrs.
Unit 9: Evaluate different types of breeding methods and their advantages and limitations (Inbreeding, Cross breeding, Out crossing)	4 Hrs.

Textbook and Reference Books

1. Lasley, J. F. (1963). *Genetics of livestock improvement* (3rd ed.). Prentice Hall, Englewood Cliffs, New Jersey.
2. Hutt, F.B. (1982). *Animal genetics*. John Wiley & Sons, Inc, New York.
3. Warwick, & Legates. (1979). *Breeding and improvement of farm animals*. McGraw-Hill publisher.
4. Banerjee, G.C. (1964). *A text book of animal husbandry* (8th ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	Total
Unit Hours	4	3	2	4	2	5	7	6	9	3	45
Marks	5	5	5	5	5	10	15	10	15	5	80

Second Year/ Second Semester

Introduction to Animal Production and Management - II

(Horse/Mule, Swine, Rabbit, Pet and Lab Animals)

(AG2201AS)

Year: II **Total: 8 hours /week**

Semester: II **Lecture: 4 hours/week**

Tutorial: hour/week

Practical: 4 hours/week

Lab: hours/week

Course Description

This course is designed to provide the concept, scope and importance of non-ruminants animal production in Nepal. The course covers digestive system and mechanism of digestion in non-ruminants; reproductive system and mechanism of reproduction in non-ruminants. Specifically, the course covers introduction, scope and importance of swine production; breeds of swine; housing and feeding in swine; care and management of sow, boar, piglet, gilt and fatteners; introduction, scope, importance of rabbit production in Nepal; major breeds of rabbit; housing and feeding in rabbit; sexing and coprophagy in rabbit; care and management of pregnant doe, breeding buck, new born bunnies; introduction, importance and scope of pet animals; major breeds of dog and cat; housing and feeding in dog and cat; care and management of pregnant bitch, pregnant queen, newborn kitten and puppies; restraining of dog and cat; introduction, scope and importance of equine animals, major breeds of equine; housing and feeding of equine; care and management of pregnant mare and fowls; shoeing techniques in horse; lameness in horse; common diseases and parasites in non-ruminants and their preventive measures. This also course provides basic knowledge of pet and laboratory animals including their nutrition, their health and welfare management, breeding, prevention, and treatment for major diseases.

Course Objective

After completion of this course students will be able to:

1. Describe about general concept related to non-ruminant production practices;
2. Explain about the physiology and anatomy of major non-ruminant domestic and pet animals reared in Nepal;
3. Recognize the requirement of different management practices of non-ruminants;
4. Identify the housing management, nutrition requirement, health and welfare management, breeding management, prevention and treatment for major diseases of pet and laboratory animals reared in Nepal

Course Content

Theory

Unit 1: Introduction to non-ruminants **3 Hrs.**

1.1 Introduction, importance, scope and constraints of non- ruminants production in Nepal
1.2 Zoological classification of swine, rabbit, equine, dog and cat
1.3 Difference between ruminants and non-ruminants
1.4 Terminologies related to non-ruminants

Unit 2: Physiology of non-ruminants **7 Hrs.**

2.1 Digestive system of swine, rabbit, equine, dog and cat
2.2 Mechanism of digestion in non-ruminants
2.3 Reproductive system of swine, rabbit, equine, dog and cat
2.4 Mechanism of reproduction in non-ruminants

Unit 3: Swine Production and management **10 Hrs.**

3.1 Introduction, scope, economic importance and production status of swine in Nepal
3.2 Native breeds of Swine and their characteristics
3.3 Exotic breeds of Swine and their characteristics
3.4 Planning a piggery farm
3.5 Housing and feeding requirement of different age group of swine
3.6 Nutrients requirement and nutrient deficiency symptoms in swine
3.7 Care and management of pregnant sow, postpartum sow, boar, piglet, gilt and fatteners
3.8 Common disease and parasites of swine and their prevention

Unit 4: Rabbit production and management **8 Hrs.**

4.1 Introduction, scope, economic importance and production status of rabbit in Nepal
4.2 Common breeds of rabbits
4.3 Housing requirements of rabbits
4.4 Feeding practices and coprophagy for rabbits.
4.5 Estrus cycle and breeding time for rabbits.
4.6 Sex determination and sex behaviours in rabbits
4.7 Care and management of pregnant doe, postpartum doe, breeding buck, new born bunnies.
4.8 Diseases of rabbits and their prevention
4.9 Slaughtering, skinning and gutting of rabbits

Unit 5: Pet animal production and management **14 Hrs.**

5.1 Introduction, scope and importance of pet animals
5.2 Relevance of dog and cat as pet animals.
5.3 Major dog and cat breeds found in Nepal and their characteristics
5.4 Estrus cycle, reproductive behaviour and mating in dog and cat
5.5 Care and management of pregnant bitch, pregnant queen, postpartum bitch, postpartum queen, newborn kitten and puppies
5.6 Restraining of dog and cat
5.7 Major disease of dogs and cats and their prevention measures

Unit 6: Equine Production and management **12 Hrs.**

6.1 Introduction, scope and economic importance of equine
6.2 Major anatomical features of equines
6.3 Major breeds of equines
6.4 Housing of equine
6.5 Feeding of draft and race horses, donkey and mules
6.6 Estrus cycle, breeding behavior, reproductive behavior in equines
6.7 Care and management of pregnant mares, pregnant foals, postpartum mares and postpartum foals
6.8 Shoeing in equines
6.9 Lameness in horses
6.10 Major disease and parasite in equines and their prevention measures.

Unit 7: Laboratory animal production and Management: **6 Hrs.**

7.1 General knowledge about laboratory animals' production and management
7.2 Handling of Lab animal
7.3 Maintenance and care of laboratory animal
7.4 Understand an appropriate environmental condition
7.5 General feeding management of laboratory animals
7.6 Water and balanced diet arrangement for laboratory animals

7.7 Prevention and treatment of major diseases of laboratory animals

Practical

Practical 1: Visit stud farms and other horse stables **12 Hrs.**

1.1 Observe equine housing, feed types and feeding practices
1.2 Observe breeding methods of horses
1.3 Observe equine shoes and shoeing methods
1.4 Observe shoeing types for different lameness management

Practical 2: Identify rabbit rearing practices **10 Hrs.**

2.1 Identify breeds of rabbit
2.2 Prepare houses for rabbit
2.3 Prepare feed for rabbit
2.4 Observe rabbit breeding
2.5 Perform rabbit skinning

Practical 3: Identify dog and cat management practices **12 Hrs.**

3.1 Identify breeds of dog and cat
3.2 Preform feeding in dogs and cats
3.3 Observe breeding in dogs and cats
3.4 Perform restraining in dogs and cats
3.5 Perform vaccination and identify importance of vaccination in dogs and cats

Practical 4 Identify swine management practices **16 Hrs.**

4.1 Identify breeds of swine
4.2 Observe housing system of swine
4.3 Perform feeding in swine
4.4 Perform identification/marking techniques (ear notching, tagging and tattooing) in swine.
4.5 Perform castration, pig-iron administration and vaccination in swine
4.6 Perform ration formulation of pig
4.7 Calculate economics of pig raising

Practical 5: Identify practices of laboratory animal production **10 Hrs.**

5.1. Identify different laboratory animal species
5.2. Prepare accommodation space for laboratory animals
5.3. Perform feeding in laboratory animals
5.4. Perform breeding management of laboratory animals
5.5. Preform housing sanitation of laboratory animals

Reference books

1. Chakrabarti, A. (2014). *Dogs their care and treatment*. Kalyani Publishers, New Delhi, India.
2. Ranjan, A. (2019). *A handbook of pet care and management*. Satish Serial Publishing Home, Delhi, India.
3. Abraham, J. (2020). *Swine production and management*. CRC Press, Florida, USA.
4. Sah, J., Sah, P., & Sah, J.K. (2019). *Jibachha's textbook of Equine, Rabbit and pet animals*. Jibachha Publication, Chitwan, Nepal.
5. Dimri, U., Sharma, M.C., & Tiwari, R. (2013). *Swine production and health management*. New India Publishing Agency, India.
6. Banday, M.T., Adil, S., & Akand, A.H. (2021). *Fundamentals of laboratory animal production and management*. Satish Serial Publishing House, India.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	Total
Unit Hours	3	7	10	8	14	12	6	60
Marks	5	10	15	10	20	15	5	80

Basic Livestock Health Management – II

(AG2202AS)

Year: II **Total: 8 hours /week**
Semester: II **Lecture: 4 hours/week**
Tutorial: hour/week
Practical: 4 hours/week
Lab: hours/week

Course Description:
This course is designed to provide knowledge on common bacterial diseases of livestock and poultry their treatment and control, common viral diseases of livestock and poultry and their prevention, diagnose and treat Fungal diseases of livestock, external and internal parasitic diseases, their treatment and control, protozoan diseases and their treatment. The course also deals with metabolic diseases of livestock and their treatment, vitamins and mineral deficiency diseases and their management, zoonotic diseases and their control.

Course Objectives

After completion of this course students will be able to:

1. Describe about the common bacterial, viral, fungal, and protozoal diseases of livestock;
2. Identify and manage external and internal parasites;
3. Recognize the status of Metabolic diseases of livestock;
4. Identify the roles of animals in the transmission of Zoonotic diseases and perform their prevention measures.

Course Content

Theory

Unit 1: Bacterial diseases of livestock **10 Hrs.**

1.1 Common bacterial diseases of livestock
1.2 Introduction, causative agent, clinical signs, diagnosis, treatment, control and prevention of:
- 1.2.1 Hemorrhagic septicemia
- 1.2.2 Anthrax
- 1.2.3 Black Quarter
- 1.2.4 Mastitis
- 1.2.5 Tetanus
- 1.2.6 Brucellosis
- 1.2.7 Foot rot
- 1.2.8 Enterotoxaemia
- 1.2.9 Strangles and Glanders
- 1.2.10 CBPP and CCPP

Unit 2: Bacterial diseases of poultry **8 Hrs.**

2.1 Common bacterial diseases of poultry
2.2 Introduction, causative agent, clinical signs, diagnosis, treatment, control and prevention of:
- 2.2.1 Pullorum
- 2.2.2 Chronic respiratory disease
- 2.2.3 Colibacillosis
- 2.2.4 Fowl typhoid

2.2.5 Mycoplasmosis

Unit 3: Viral diseases of Livestock **7 Hrs.**

3.1 Common viral diseases of livestock

3.2 Introduction, causative agent, clinical signs, diagnosis, treatment, control and prevention of:

3.2.1 Rabies
3.2.2 Rinderpest
3.2.3 Foot and mouth disease (FMD)
3.2.4 Pestes petits ruminant (PPR)
3.2.5 Swine fever
3.2.6 Canine distemper

Unit 4: Viral diseases of poultry **8 Hrs.**

4.1 Common viral diseases of poultry

4.2 Introduction, causative agent, clinical signs, diagnosis, treatment, control and prevention of:

4.2.1 Ranikhet disease
4.2.2 Gumboro disease
4.2.3 Marek's disease
4.2.4 Infectious bronchitis
4.2.5 Fowl pox
4.2.6 Avian influenza

Unit 5: Fungal diseases of livestock and poultry **5 Hrs.**

5.1 Common fungal diseases of livestock and poultry

5.2 Introduction, causative agent, clinical signs, diagnosis, treatment, control and prevention of:

5.2.1 Ring worm
5.2.2 Fungal Dermatitis
5.2.3 Mycotoxiosis
5.2.4 Aspergillosis in poultry

Unit 6: Protozoal diseases of livestock and poultry **5 Hrs.**

6.1 Common protozoal diseases of livestock and poultry

6.2 Introduction, causative agent, clinical signs, diagnosis, treatment, control and prevention of:

6.2.1 Anaplasmosis
6.2.2 Babesiosis
6.2.3 Trypanosomiasis
6.2.4 Theileriosis
6.2.5 Coccidiosis in livestock and poultry

Unit 7: Ecto- and Endo-parasitic diseases of livestock and poultry **7 Hrs.**

7.1 Common ecto- and endo-parasitic diseases of livestock and poultry

7.2 Introduction, causative agent, clinical signs, diagnosis, treatment, control and prevention of:

7.2.1 Fasciolosis
7.2.2 Amphistomiasis
7.2.3 Round worm of ruminants – large and small
7.2.4 Round worm of pig and poultry
7.2.5 Gid
7.2.6 Ectoparasitic infestation of lice and ticks

7.2.7 Ectoparasitic infestation of mites and leaches

Unit 8: Metabolic and deficiency diseases of livestock and poultry 8 Hrs.

8.1 Common metabolic and deficiency diseases of livestock and poultry

8.2 Introduction, etiology, clinical signs, diagnosis, treatment, control and prevention of:

8.2.1 Milk Fever
8.2.2 Grass Tetany
8.2.3 Ketosis
8.2.4 Visceral gout in poultry
8.2.5 Rickets
8.2.6 Vitamin deficiency in livestock and poultry
8.2.7 Mineral deficiency in livestock and poultry

Unit 9: Basic concepts of Zoonotic diseases 2 Hrs.

9.1. Important of zoonotic diseases and concept of one health
9.2. Milk borne zoonotic diseases
9.3. Meat borne zoonotic diseases

Practical

Practical 1: Examine of milk and CMT	4 Hrs.
Practical 2: Perform sterilization and preparation of glassware for culture	4 Hrs.
Practical 3: Prepare media	4 Hrs.
Practical 4: Examine milk culture and Gram's staining	4 Hrs.
Practical 5: Perform vaccination in livestock and poultry	4 Hrs.
Practical 6: Identify common internal parasites of cattle and buffaloes	4 Hrs.
Practical 7: Identify common internal parasites of sheep and goat	4 Hrs.
Practical 8: Identify common internal parasites of poultry	4 Hrs.
Practical 9: Identify external parasites of livestock	4 Hrs.
Practical 10: Identify external parasites of poultry	4 Hrs.
Practical 11: Collect blood and examine the protozoa	4 Hrs.
Practical 12: Examine urine for ketone bodies	4 Hrs.
Practical 13: Perform skin scrapping	4 Hrs.
Practical 14: Perform postmortem of sheep or goat	4 Hrs.
Practical 15: Perform postmortem of poultry	4 Hrs.

Reference Books:

1. Dhakal, I.P., Singh, S. and Lyon, R. (2020). Preventive Veterinary Medicine, A textbook of infectious diseases of cattle, buffalo, horse, sheep, goat, swine, dog and cat. 1st edition, ISBN 9789937075633.
2. Chakrabarti, A. (2007). A textbook of Preventive Veterinary Medicine, Kalyani Publishers, India.
4. Sharma, R.D., Kumar, M and Sharma, M.C. (2013). Textbook of Preventive Veterinary Medicine and Epidemiology. Indian Council of Agriculture Research (ICAR), India.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	Total
Unit Hours	10	8	7	8	5	5	7	8	2	60
Marks	15	10	10	10	5	5	10	10	5	80

Elementary Animal Reproduction

(AG2203AS**)**

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

Semester: II **Lecture: 3 hours/week**

Tutorial: hour/week

Practical: 2 hours/week

Lab: hours/week

Course Description

The course is designed to provide the elementary knowledge on anatomy and physiology of reproductive system of different domestic animals, pregnancy diagnosis, semen collection, artificial insemination, embryo transfer technology, reproductive disorders and diseases, obstetrical problems, obstetrical techniques.

Course Objectives

After completion of this course students will be able to:

1. Describe the anatomy and physiology of reproduction;
2. Describe the basics of reproduction and reproductive disorders;
3. Perform reproductive techniques like Artificial Insemination (AI) and Embryo Transfer (ET)

Course Contents:

Theory

Unit 1: Comparative anatomy of reproductive tracts of Domestic Animals 4 Hrs.

1.1 Male Reproductive Tract
1.2 Female Reproductive Tract
1.3 Mammary Gland

Unit 2: Reproductive Hormones and their Functions 4 Hrs.

2.1 Hypothalamus
2.2 Pituitary
2.3 Testis
2.4 Ovary
2.5 Placenta

Unit 3: Physiology of Reproduction 7 Hrs.

3.1 Puberty and Sexual Maturity
3.2 Spermatogenesis
3.3 Oogenesis and Ovulation
3.4 Estrus Cycle
3.5 Sign of Heat
3.6 Conception and Gestation
3.7 Hormonal Regulation of Pregnancy
3.8 Stages of Parturition
3.9 Mammary Gland and Lactation

Unit 4: Pregnancy Diagnosis 3 Hrs.

4.1 Pregnancy Diagnosis in Small Ruminants

4.2 Pregnancy Diagnosis in Large Ruminants: Rectal Palpation
4.3 Biological and Chemical methods of Pregnancy Diagnosis

Unit 5: Artificial Insemination **3 Hrs.**
5.1 Introduction to Artificial Insemination
5.2 Advantages and Disadvantages of AI
5.3 Insemination Technique: Sterilization of AI Instrument, Assimilation of AI set and Insemination

Unit 6: Semen Collection **3 Hrs.**
6.1 Semen Collection and Artificial Vagina
6.2 Evaluation, Dilution, Preservation and Transport of semen
6.3 Precaution of Handling Semen in Liquid Nitrogen

Unit 7: Embryo Transfer **3 Hrs.**
7.1 Advantages and Disadvantages of Embryo Transfer Technology
7.2 Collection and Storage of Embryo
7.3 Transfer of Embryo

Unit 8: Reproductive disorders **4 Hrs.**
8.1 Anoestrus
8.2 Silent Heat
8.3 Ovarian Cyst
8.4 Repeat Breeding
8.5 Endometritis and cervicitis

Unit 9: Reproductive Diseases **4 Hrs.**
9.1 Leptospirosis
9.2 Brucellosis
9.3 Campylobacteriosis
9.4 Trichomoniasis
9.5 Pyometra

Unit 10: Obstetrical Problems **6 Hrs.**
10.1 Dystocia
10.2 Retention of Placenta
10.3 Uterine Torsion
10.4 Vaginal and Uterine Prolapse
10.5 Abortion
10.6 Mummification and Maceration

Unit 11: Obstetrical Techniques **4 Hrs.**
11.1 Fetotomy
11.2 Epidural Anesthesia
11.3 Mutation and Force Extraction
11.4 Cesarean Sections

Practical

Unit 1: Identify the organs of reproductive tract of female animal 4 Hrs.

Unit 2: Identify the organs of reproductive tract of male animal 4 Hrs.

Unit 3: Detect heat in different domestic animals 2 Hrs.

Unit 4: Diagnose pregnancy by rectal palpation in large animals 4 Hrs.

Unit 5: Diagnose pregnancy in Small Animals 2 Hrs.

Unit 6: Identify different parts of AI Gun, their assembling and AI technique 4 Hrs.

Unit 7: Collect and preserve semen 2 Hrs.

Unit 8: Identify different reproductive diseases and obstetrical problems 4 Hrs.

Unit 9: Study different Metabolic Diseases and their Treatment 2 Hrs.

Unit 10: Study different obstetrical techniques: Fetotomy, Epidural Anesthesia, Mutation and Force Extraction 2 Hrs.

Reference Books:

1. Fasso, D. (Ed.). (2016). *Animal reproduction and physiology*. Syrawood Publishing House.
2. Banerjee, G.C. (1964). *A textbook of animal husbandry* (8th ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.
3. Hafez, E.S.E., & Hafez, B. (2013). *Reproduction in farm animals* (7th ed.). Wiley-Blackwell Publication, UK.
4. Singh, S. (2016). *Animal reproduction and gynecology*. Bioscientific Publisher, India

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	Total
Unit Hours	4	4	7	3	3	3	3	4	4	6	4	45
Marks	5 or 10	5 or 10	10 or 15	5	5	5	5	5 or 10	5 or 10	10	5 or 10	80

Introduction to One Health, Zoonosis and Food Safety

(AG2204AS**)**

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

Semester: II **Lecture: 3 hours/week**

Tutorial: hour/week

Practical: 2 hours/week

Lab: hours/week

Course description:

This course is designed to provide the concept of Public Health, Zoonosis and One Health. The course includes issues of animal protection and human health with subsequent reduction of loss of livestock economy and health hazards. The course covers aspects concerned with human-animals-environment interactions in respect of disease occurrence, impact of zoonotic diseases on health, prevention, and control of zoonotic diseases, food safety, food production and the security of food chain, biosecurity and hygienic management in livestock farm, live animal market, slaughterhouse, dairy barn and food centers.

Course objectives:

After completion of this course students will be able to:

1. Explain about One Health and Zoonoses;
2. Explain the impact of environment and residues on the health of domestic animals, wild animals, and humans;
3. Identify, diagnose, prevent and report major zoonotic diseases in Nepal under one health approach;
4. Explain the aspects of food safety.

Course Contents

Theory

Unit 1: Concepts in Veterinary Public Health **2 Hrs.**

1.1 Introduction of Veterinary Public health (VPH) and Zoonoses

1.2 Their importance in livestock and public health with people-animals-environment interface, and all of its interactions.

Unit 2: One Health Basics **4 Hrs.**

2.1 Concepts and importance of One Health

2.2 History of One Health

2.3 Common One Health issues

2.4 Opportunities for one health in Nepal

2.5 Challenges for One Health in Nepal

2.6 Strategy and Practices of One Health in Nepal

Unit 3: Impact and classification of Zoonotic diseases **4 Hrs.**

3.1 Impact of zoonotic diseases on health

3.2 Scope and approaches from veterinary and human health related research to address zoonotic diseases

3.3 Integrating interdisciplinary methodologies on health

3.4 Classification of zoonosis

Unit 4: Concepts of Chemical and Antimicrobial Residues (AMR) 2 Hrs.

4.1 Basics of chemical residues and antimicrobial residues (AMR) on One Health
4.2 Impact of chemical residues and antimicrobial residues (AMR) on One Health
4.3 Antimicrobial uses residues and resistance

Unit 5: Bacterial Zoonosis 6 Hrs.

5.1 Introduction and examples of bacterial zoonosis
5.2 Introduction, causes, transmission, symptoms, diagnosis, prevention, and control of Brucellosis with one health approach
5.3 Introduction, causes, transmission, symptoms, diagnosis, prevention, and control of Tuberculosis with one health approach
5.4 Introduction, causes, transmission, symptoms, diagnosis, prevention, and control of Anthrax with one health approach
5.5 Introduction, causes, transmission, symptoms, diagnosis, prevention, and control of Leptospirosis with one health approach

Unit 6: Viral Zoonosis 5 Hrs.

6.1 Introduction and examples of viral zoonosis
6.2 Introduction, causes, transmission, symptoms, diagnosis, prevention, and control of Rabies with one health approach
6.3 Introduction, causes, transmission, symptoms, diagnosis, prevention, and control of Bovine Spongiform Encephalopathy (BSE) with one health approach
6.4 Introduction, causes, transmission, symptoms, diagnosis, prevention, and control of Japanese Encephalitis (JE) with one health approach
6.5 Introduction, causes, transmission, symptoms, diagnosis, prevention, and control of Dengue with one health approach

Unit 7: Parasitic Zoonosis 3 Hrs.

7.1 Introduction and examples of parasitic zoonosis
7.2 Introduction, causes, transmission, symptoms, diagnosis, prevention, and control of Toxoplasmosis with one health approach
7.3 Introduction, causes, transmission, symptoms, diagnosis, prevention, and control of Echinococcosis with one health approach
7.4 Introduction, causes, transmission, symptoms, diagnosis, prevention, and control of Cysticercosis with one health approach

Unit 8: Emerging and re-emerging zoonosis 2 Hrs.

8.1 Understanding emerging and re-emerging zoonosis
8.2 Control strategies of emerging and re-emerging zoonosis

Unit 9: Biosecurity and hygiene for zoonotic disease prevention 3 Hrs.

9.1. Concepts and importance of Biosecurity and Hygiene
9.2. Biosecurity and hygienic management in livestock farm and live animal market
9.3. Biosecurity and hygiene practices of slaughterhouse, dairy barn and food centers

Unit 10: Food Quality and Food Safety 6 Hrs.

10.1. Food safety, food production and the security of food chain.
10.2. Basic concepts and significance of food safety
10.3. Understanding contamination and adulterations
10.4. Good practices for food storage

10.5. International organizations and agreements in food standards, quality, research and trade
10.6. Food Safety Management Systems

Unit 10: Food Microbiology and Foodborne Diseases **4 Hrs.**

11.1 Food Microbiology and Foodborne diseases
11.2 Food spoilage and its process
11.3 Food preservation and its practices
11.4 Beneficial role of microorganisms and food storage
11.5 Importance of safe food handling

Unit 11: Food Quality and standards **4 Hrs.**

12.1 Food quality and food standards
12.2 Hazard analysis and critical control point (HACCP)
12.3 Genetically modified food and artificial food
12.4 Risk Assessment and Accreditation in food sector
12.5 Food labeling and packaging
12.6 Food standards and regulations in Nepal

Practical

Unit 1:	Study zoonotic diseases at community level	4 Hrs.
Unit 2:	Study rural community on one health aspect	2 Hrs.
Unit 3:	Visit nearby human health center to know the common zoonotic diseases present in the area	4 Hrs.
Unit 4:	Visit nearby veterinary health center to know the common zoonotic diseases present in the area	4 Hrs.
Unit 5:	Handle milk and milk products on food safety perspective	2 Hrs.
Unit 6:	Common adulteration practices in milk and milk products	2 Hrs.
Unit 7:	Handle meat and meat products on food safety perspective	2 Hrs.
Unit 8:	Handle eggs on food safety perspective	2 Hrs.
Unit 9:	Handle fish on food safety perspective	2 Hrs.
Unit 10:	Identify common zoonotic diseases transmissible from milk, meat, eggs and fish	2 Hrs.
Unit 11:	Visit a nearby live animal market to assess biosecurity and hygiene measures	2 Hrs.
Unit 12:	Visit a nearby slaughterhouse market to assess biosecurity and hygiene measures	2 Hrs.

Reference Books:

1. Acha, P.N. and B. Szyfres (1989). Zoonoses and Communicable disease common to man and animals (second edition). Pan American Health Organization, USA.
2. Krauss, H., Schieffer, H.G., Slenczka, W., Weber, A. and Zahner, H. (2003). Zoonoses: Infectious diseases transmitted from animals to human being. Amer Society for Microbiology.
3. Atlas, R. M. and Maloy, S. (2014). One Health: People, Animals, and the Environment (ASM Books) 1st Edition, Amer Society for Microbiology.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	12	Total
Unit Hours	2	4	4	2	6	5	3	2	3	6	4	4	45
Marks	5	5 or 10	5 or 10	5	10	10	5	5	5	10	5 or 10	5 or 10	80

Fundamentals of Aquaculture and Fisheries

(AG2205PS**)**

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

Semester: II **Lecture: 3 hours/week**

Tutorial: hour/week

Practical: 2 hours/week

Lab: hours/week

Course description:

This course is designed to basic knowledge of fish, fisheries, aquaculture, desirable characters fish and biology of cultivated aquaculture species. This course equips the students with basic knowledge and skill about the principles and practices of aquaculture including fish farming, cage fish culture, fish breeding, management of common of disease and parasites, live transportation and marketing of fish.

Course objectives:

After completion of this course students will be able to:

1. Explain the importance of Aquaculture;
2. Compare different types fish farming system;
3. Explain cultivated and food fishes of Nepal;
4. Identify common fish diseases in Nepal;
5. Perform fish culture.

Course Contents:

Theory

Unit 1: Introduction to Fisheries: 7 Hrs.

1.1. Definition of Fish, fisheries and aquaculture
1.2. General character of Fish
1.3. General morphology of Fish: external features, scale and fin of fishes
1.4. Taxonomy of the fishes of Nepal
1.5. Desirable characters and biology of fish for culture Overview of entrepreneur and entrepreneurship

Unit 2: Pond, cage and pond fish culture: 10 Hrs.

2.1 Fish farming system, extensive, semi-intensive, intensive and super intensive
2.2 Cage and pen fish culture in Nepal
2.3 Monoculture
2.4 Polyculture
2.5 Integrated fish culture
2.6 Raceway culture

Unit 3: Water quality and pond management: 10 Hrs.

3.1. Desirable range of water quality parameter
  3.1.1. Temperature
  3.1.2. Dissolved oxygen
  3.1.3. pH
  3.1.4. Planktons
  3.1.5. Turbidity
3.2. Pond management
  3.2.1. Pond liming
  3.2.2. Pond fertilization
  3.2.3. Food and feeding
  3.2.4. Aquatic weeds and their control
  3.2.5. Predatory fish and their control

Unit 4: Fish breeding: **10 Hrs.**

4.1. Role of fish seed in fish culture
4.2. Identification of brood fish and their management
4.3. Types of fish breeding
4.4. Natural, semi-artificial and artificial breeding
4.5. Induced breeding
4.6. Spawning of fish
4.7. Incubating and hatching
4.8. Hatchling and rearing
4.9. Transfer to nursery pond

Unit 5: Common fish diseases and parasites: **8 Hrs.**

1.1 Common fish parasites and diseases in Nepal
  5.1.1 Causes and etiology
  5.1.2 Symptoms and species affected
  5.1.3 Types of fish disease, infectious and non-infectious
1.2 Protozoan fish disease, causal organism, symptom and control measures
1.3 Fungal fish disease, causal organism, symptom and control measures
1.4 Bacterial fish disease, causal organism, symptom and control measures
1.5 Worm and crustacean fish disease, causal organism, symptom and control measures
1.6 Non-infectious disease caused by water quality, nutritional and control measures

Practical

Unit 1: Identify external and internal body parts of fish	2 Hrs.
Unit 2: Collect and identify fishes of Nepal of least 4 orders	4 Hrs.
Unit 3: Identify of cultivated exotic and indigenous fish species	3 Hrs.
Unit 4: Collect water sample	2 Hrs.
Unit 5: Record water temperature and pH	2 Hrs.
Unit 6: Record dissolved oxygen and turbidity	2 Hrs.
Unit 7: Collect and identify planktons	2 Hrs.
Unit 8: Fertilize/manure fish pond	2 Hrs.
Unit 9: Identify aquatic weeds and predatory fish	2 Hrs.
Unit 10: Formulate fish ration	2 Hrs.
Unit 11: Identify brood fish and breeding equipment	2 Hrs.
Unit 12: Extract the pituitary gland of fish	2 Hrs.
Unit 13: Collect/identify/control common parasites of fish	3 Hrs.

References:

1. Shrestha, M.K., Pandit, N.P. (2007). *Principles of aquaculture* (2nd ed.). Department of Aquaculture, Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal.
2. Augusty, K.T. (1979). *Fish farming in Nepal.* Archana Printers & Publisher, Kottayam 29, India.
3. Brown, E.E. & Gratzek, J.B. (1992, June). *Fish farming hand book.* Van Nostrand Reinhold company, New York. doi.org/10.1002/rrr.3450070212
4. Shrestha, T.K., & Jha, D.K. (1993). *Introduction to fish culture.* Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal.
5. Woynarovich, E. (1975). *Elementary guide to fish culture in Nepal.* Food and Agriculture Organization of the United Nations, Rome.

Final written exam marking scheme

Unit	1	2	3	4	5	Total
Unit Hours	7	10	10	10	8	45
Marks	10	20	20	20	10	80

Agri-Economics and Farm Management

(AG2206PS**)**

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

Semester: II **Lecture: 4 hours/week**

Tutorial: hour/week

Practical: 2 hours/week

Lab: hours/week

Course description:

This course is designed to provide the knowledge on basic economics and farm management skills based on economic principles. The entire course deals with explaining the introduction, importance, assumptions and limitations of economics. The course deals with concerns of consumers' behavior, cost concepts and market types. Similarly, in the part of Farm Management, the course covers introduction, importance and problems of farm management in Nepal. It deals with production relationships and principals involved in farm management decisions. The course also covers the aspects of farm planning, farm budgeting, farm inventory and records keeping, farm efficiency measures and farm business.

Course objectives:

After completion of this course students will be able to:

1. Describe the general concept and principle of economics particularly in relation to production, marketing, distribution and consumption;
2. Draw the profit maximization condition under various production relationships;
3. Prepare an effective farm plan and farm budget;
4. Prepare and maintain farm records;
5. Analyze farm efficiency;
6. Locate risks and risk mitigating strategies in agriculture.

Course Contents:

Theory

Unit 1: Introduction to Economics: 4 Hrs.

1.1. General definition and assumptions of Economics
1.2. Definition of economics given by Adam Smith, Characteristics, Criticism
1.3. Marshall's welfare definition of economics, Characteristics, Criticism
1.4. Robin's Scarcity definition of economics, Characteristics, criticism
1.5. Comparison between Marshall and Robin's definition of Economics
1.6. Importance, Subject matter and Limitation of Economics

Unit 2: Basic concepts of Economics: 2 Hrs.

2.1. Concept of goods, utility, value, price, wealth, production, consumption, equilibrium and margin

Unit 3: Consumer's Behavior: 3 Hrs.

3.3. Concept and assumptions of ordinal and cardinal approach of utility measurement
3.4. Concept, assumption, explanation and exceptions of law of diminishing marginal utility
3.5. Indifference curve and its properties.
3.6. Concept of price line/budget line, marginal rate of substitution, consumers

Unit 4: Demand and Law of Demand: **3 Hrs.**

4.1 Definition and determinants of demand
4.2 Law of demand (concept, explanation and exceptions)
4.3 Movement and shift in demand curve
4.4 Elasticity of demand and its types
4.5 Definition and concept of price elasticity, income elasticity and cross elasticity of demand

Unit 5: Demand and Law of Supply: **2 Hrs.**

5.1 Definition and determinants of supply
5.2 Law of supply (concept, explanation and exceptions)
5.3 Movement and shift in supply curve
5.4 Concept of elasticity of supply and its types

Unit 6: Concept of Cost and Revenue **3 Hrs.**

6.1 Cost and its types
6.2 Concept of various long run and short run cost curve
6.3 Relation between average cost and marginal cost, average variable cost and marginal cost, Short run and long run cost curve
6.4 Concept of Revenue
6.5 Concept of Average revenue, marginal revenue and their relationship
6.6 Uses of cost and revenue concept

Unit 7: Market and its types **4 Hrs.**

7.1 Definition of market and classification of market on basis of competition.
7.2 Concept of perfect competitive market (Definition, characteristics, price and output determination)
7.3 Concept of monopoly market (Definition, characteristics, price and output determination)
7.4 Concept of monopolistic market (Definition and characteristics)

Unit 8: Factors of Production **3 Hrs.**

8.1 Land (Definition and characteristics), Rent (Definition and types) and Quasi-rent
8.2 Labour (Definition and characteristics) and Wage (Definition and types)
8.3 Capital (Definition, characteristics and types) and Interest (Definition and types)
8.4 Organization (Definition and characteristics) and Profit (Definition and types)

Unit 9: Introduction to Farm Management **3 Hrs.**

9.1 Concept of farm management
9.2 Nature/ Characteristics of farm management
9.3 Scope of farm management
9.4 Importance of farm management
9.5 Problem related to farm management

Unit 10: Management of farm resources **2 Hrs.**

10.1 Concept of land, labour, mechanization, farm layout
10.2 Interrelationship between various component of farming system

Unit 11: Input-Input Relationship (Factor-Factor Relationship) **3 Hrs.**

11.1 Concept of isoquant, iso-cost line, marginal rate of technical substitution, price ratio, isocline, ridge line and expansion path.

11.2 Substitution in factor-factor relationship (Fixed Proportion Combination, increasing rate, Decreasing rate and Constant Rate of Substitution)
11.3 Characteristics of isoquant
11.4 Least cost combination and different methods of calculating least cost combination

Unit 12: Output-Output Relationship (Product-Product Relationship) 3 Hrs.
12.1 Concept of production possibility curve (PPC), iso-revenue line, marginal rate of product substitution
12.2 Types of product-product relationship (joint product, complementary product, supplementary product, competitive product and antagonistic product)
12.3 Profit maximization under output-output relationship

Unit 13: Input-Output Relationship (Factor-Product Relationship) 4 Hrs.
13.1 Concept of input-output relationship and production function
13.2 Law of return
13.3 Three regions of production function
13.4 Relation between TP and MP, AP and MP

Unit 14: Principles Involved in Farm management decision 6 Hrs.
14.1 Principle of diminishing return
14.2 Cost principle
14.3 Principle of factor substitution
14.4 Principle of combining enterprises
14.5 Principle of equi-marginal return
14.6 Principle of comparative advantage
14.7 Principle of time comparison
14.8 Opportunity cost principle

Unit 15: Farm Planning and budgeting 5 Hrs.
15.1 Definition, types and characteristics of good farm planning
15.2 Definition of farm budgeting
15.3 Brief concept about types of farm budgeting (complete, partial and enterprise budgeting)
15.4 Steps in farm planning and budgeting

Unit 16: Farm Record Keeping and Depreciation 4 Hrs.
16.1 Brief Concept of Balance Sheet, Income Statement and Cash Flow Statement
16.2 Definition of farm inventory and process of taking farm inventory
16.3 Concept of depreciation and methods of calculating depreciation

Unit 17: Farm Efficiency Measure 4 Hrs.
17.1 Concept of farm efficiency
17.2 Measuring farm efficiency (physical efficiency and financial efficiency)

Unit 18: Risk and Uncertainty 2 Hrs.
18.1 Concept of risk and uncertainty
18.2 Types of risk and uncertainty in Nepalese agriculture
18.3 Management of risk and uncertainty in farm

Practical

Unit 1: Calculate least cost combination	2 Hrs.
Unit 2: Calculate optimum product combination	2 Hrs.
Unit 3: Categorize three regions of production function	2 Hrs.
Unit 4: Prepare enterprise and partial budget	4 Hrs.
Unit 5: Prepare income statement and balance sheet	4 Hrs.
Unit 6: Calculate depreciation of farm assets	2 Hrs.
Unit 7: Calculate farm efficiency	3 Hrs.
Unit 8: Prepare farm inventory	3 Hrs.
Unit 9: Locate agriculture risk and mitigation practices adopted by farmers	3 Hrs.
Unit 10: Report farming practices and system adopted by farmers	3 Hrs.
Unit 11: Compare of time value of money	2 Hrs.

References:

1. Chopra, P.N. (2000). *Principle of economics*. Kalyani Publishers, New Delhi.
2. McConnel, C.R. (1975). *Economics: Principles, problems and policies*. McGraw-Hill, USA.
3. Johl, S. S., & Kapoor, T. R. (1973). *Fundamentals of farm business management*. Kalyani Publishers, New Delhi.
4. Kay, R.D., & Edwards, W. M. (1994). *Farm management*. McGraw Hill, Inc., New Delhi.
5. Shankhyan, P. L. (1983). *Introduction to farm management*. Tata, McGraw-Hill, Co. Ltd., New Delhi.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Unit Hours	4	2	3	3	2	3	4	3	3	2	3	3	4	6	5	4	4	2	60
Marks	5 or 10		5	5	5 or 10		5	5	5	5 or 10		5	5	5	5	5	5 or 10		80

Third Year/ First Semester

Introductory Poultry Production & Management

(AG3101AS)

Year: III **Total: 6 hours /week**
Semester: I **Lecture: 4 hours/week**
Tutorial: hour/week
Practical: 2 hours/week
Lab: hours/week

Course description:

This course is designed to provide the basic knowledge and skills on poultry farming including breeds of chicken, housing, care and management of broiler and layer chicken for commercial farming and hatchery. It also aims to provide fundamental knowledge of marketing of chicken meat and eggs. The entire course deals with acquiring, and developing knowledge, skills and confidence that are necessary to commence and run a commercial poultry production and hatchery management.

Course objectives:

After completion of this course students will be able to:

1. know the scope and importance of poultry farming in Nepal;
2. Identify different breeds of chicken;
3. Design poultry house for commercial farming and hatchery;
4. Perform care and management of chicks, grower and layers;
5. Explain poultry breeding;
6. Explain feeds and feeding of poultry;
7. Develop marketing skills of meat and eggs.

Course Contents:

Theory

Unit 1: Introduction, scope, history, problem, prospect and strategy of poultry farming in Nepal **5 Hrs.**

1.1 Introduction of poultry production in Nepal
- 1.1.1 History, scope and importance of poultry production in Nepal
- 1.1.2 Present status (statistics), problems and prospects of poultry production in Nepal

1.2 Government policies for poultry farming, feed and hatchery industry in Nepal
- 1.2.1 Government policies, norms, rules and regulation for poultry industry
- 1.2.2 Government and private chicken hatchery

1.3 Common terminologies used in poultry husbandry practices
- 1.3.1 Terminology: Poultry, broiler, layer, pullet, capon, rooster, incubation, fumigation, hatch, etc.

Unit 2: Commonly used chickens breeds **10 Hrs.**

2.1. Asiatic breeds of chickens
- 2.1.1. Brahma, Cohchin, Langsan

2.2. Meditarrian breeds of chickens
- 2.2.1. Leghorn, Minorka

2.3. American breeds of chickens
- 2.3.1. Rode Island Red, New Hampshire, Plymouth Rock

2.4. English breeds of chickens
    2.4.1. Austrolarp, Sussex
2.5. Common hybrid layers
    2.5.1. Hyline brown, Lomann, Isha brown, Hisex brown, Babcoc,
2.6. Common hybrid broilers
    2.6.1. Cob 500, Hubbard, Arbor Acre, Ross, Vencob etc.
2.7. Dual purpose hybrid chickens
    2.7.1. Giriraj, Kadaknath
2.8. Nepali local chickens
    2.8.1. Sakini, Ghati khuile (naked neck), Pwuankh Ulte

Unit 3: External and internal body parts of chickens **3 Hrs.**

3.1. External and internal body parts of chicken
    3.1.1. External body parts of chicken
    3.1.2. Internal body parts of chickens:
3.2. Structure of eggs
    3.2.1. Internal structure of eggs
    3.2.2. Nutrient composition of eggs
3.3. Egg grading practices

Unit 4: Housing system of poultry **6 Hrs.**

4.1. Explain housing system of poultry
4.2. Housing system: Explain deep litter housing system of poultry
    4.2.1. Floor space requirements in different age groups
    4.2.2. Purpose of farming: breeding/commercial
4.3. Site selection for poultry farm construction
4.4. Explain poultry shed construction
    4.4.1. Poultry shed Lay out
    4.4.2. Construction materials for poultry shed
    4.4.3. Standard space (area) requirement for different types of birds
    4.4.4. Litter management: litter condition, application of lime and bleaching powder
    4.4.5. Thickness of litter in summer and winter months
4.5 Modern houses: Environment controlled closed house

Unit 5: Poultry equipment and medications **3 Hrs.**

5.1. Common poultry equipment
    5.1.1. Feeder, Drinker, Nest box, Hover, Perches, Weighing balance, Debeaker, etc.
5.2. Common managemental practices of poultry farming
    5.2.1. feeding, watering, lighting, racking, egg collection, grading and culling of birds

Unit 6: Care and management of poultry birds: **13 Hrs.**

6.1. Brooding preparation
    6.1.1. Installation of hover, height of brooder, chick guard, fitting light, temperature maintaining, litter placing, checking water sources, emergency light source, etc.
6.2. Care and management of day-old chicks (0-8 weeks)

6.3. Receiving chicks from reliable hatchery, maintaining biosecurity, feeding practices of chicks, incorporation of electrolytes, vitamin and antibiotics in feed or water in order to prevent early chick mortality, vaccination, record keeping

6.4. Care and management of growers (8-18 weeks)

6.4.1. Bio-security measure, feeding practices of growers, feed restriction, reducing artificial light, molting, debeaking, vaccination, vitamin and antibiotics supplement, record keeping

6.5. Care and management of laying birds (18 weeks and above)

6.5.1 Bio-security measure, feeding practices in layer, increasing artificial light, culling and selection of layer and non-layer, vaccination, vitamin and antibiotics supplement, record keeping

6.6. Care and management of broilers

6.6.1 Bio-security measure, feeding practices in layer, increasing artificial light, culling and selection of layer and non-layer, vaccination, vitamin and antibiotics supplement, record keeping

Unit 7: Hatchery Management **6 Hrs.**

7.1 Simple concepts of hatchery design and setup

7.2 Basic equipment and machineries for hatchery establishment

7.3 Selection, handling, and storage of eggs for hatching

7.4 Hatchery eggs fumigation

7.5 Hatchery Processes: Incubation (setting, candling, transfer and hatching)

7.6 Selection, handling and storage of sellable chicks

7.7 Hatchery vaccination

7.8 Chicks handling and transportation

Unit 8: Medication, vaccination, debeaking and deworming of birds **5 Hrs.**

8.1. Common medication and their uses in poultry farming

8.1.1. Electrolytes, multivitamins, mineral supplements, anthelmintics, probiotics, etc.

8.1.2. prudential uses of antibiotics and antimicrobials

8.2. 8.2 Vaccine and vaccination in poultry, basic concepts of vaccine and vaccination

8.2.1 Vaccination schedule for broiler

8.2.2 Vaccination schedule for layer chicken

8.2.3 Vaccination method

8.2.4 Precaution to be taken for vaccination

8.3. Cold chain maintenance of vaccine during storage, handling, and transport

8.4. Debeaking in layers and breeders' birds

8.4.1 Purpose of debeaking, age and method of debeaking, precaution to be taken

8.5. 8.5 Deworming chicken

8.5.1 Anthelmintic used in poultry, dose of anthelmintic, method of deworming (with feed/water)

Unit 9: Stress management in poultry **2 Hrs.**

9.1. Protect birds from hot weather

9.1.1. Summer season management of poultry

9.2. Protect birds from chiller weather

9.2.1 Winter season management of poultry

Unit 10: Routine poultry farm operation and record keeping 5 Hrs.

10.1. Perform daily farm operation in poultry farm
  10.1.1. Selection of layer and non-layer birds
  10.1.2. Grading and culling practices of birds
10.2. Record keeping of poultry farm
  10.2.1 Calculation and record keeping of feed and water intake
  10.2.2 Record of medication and weekly/daily weight gain of birds
  10.2.3 Egg collection practices and record keeping of egg production
10.3. 10.3 Management and record keeping of sales and dead birds
  10.3.1 Management and record keeping of dead birds
  10.3.2 Management and record keeping of other farm wastes

Unit 11: Common diseases and parasites of poultry 2 Hrs.

11.1. Common infectious and non-infectious diseases of poultry
11.2. Farm Hygiene and biosecurity

Practical

Unit 1: Identify common poultry breeds of chicken 2 Hrs.
Unit 2: Study external body parts of chicken 2 Hrs.
Unit 3: Study digestive organs of poultry 2 Hrs.
Unit 4: Study of reproductive organs of poultry 2 Hrs.
Unit 5: Perform selection and culling in chicken 2 Hrs.
Unit 6: Identify common poultry tools and equipment 2 Hrs.
Unit 7: Perform poultry farms disinfection before and after arrival of chicken 2 Hrs.
Unit 8: Perform debeaking practices in layers 2 Hrs.
Unit 9: Perform deworming practices in birds 2 Hrs.
Unit 10: Perform vaccination in broilers and layers 2 Hrs.
Unit 11: Perform site selection and lay out of poultry farm 2 Hrs.
Unit 12: Perform site selection and lay out of hatchery 2 Hrs.
Unit 13: Visit of local poultry farms 2 Hrs.
Unit 14: Perform biosecurity measures and disinfection in poultry farm 2 Hrs.
Unit 15: Perform postmortem examination of poultry for disease diagnosis 2 Hrs.

Reference books

1. Banerjee, G.C. (2000). *A textbook of Animal Husbandry* (8th ed.). Oxford and IBH Publishing Co. Pvt. Ltd.
2. Charles, T.B., & Stuart, H.O. (2011). *Commercial Poultry Farming*.
3. Singh, R.A. (2017). *Poultry Production*. Kalyani Publishers, India.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	Total
Unit Hours	5	10	3	6	3	13	6	5	2	5	2	60
Marks	5	15	5	5	5	20	5	5	5	5	5	80

Introductory Veterinary Laboratory Techniques

(AG3102AS)

Year: III **Total: 5 hours /week**
Semester: I **Lecture: 3 hours/week**
Tutorial: hour/week
Practical: 2 hours/week
Lab: hours/week

Course Description

This course is designed to provide basic knowledge in laboratory techniques of disease diagnosis, commonly used terminologies in laboratory techniques and animal handling. Basically, this course is based on practical work of the students which is useful in their daily laboratory work for disease diagnosis in the hospital or even in the field. The course includes faecal examination which is the most used laboratory work in the routine diagnosis of parasitic burden while microbiological work helps in the proper diagnosis of animal diseases.

Course Objectives

After completion of this course students will be able to:

1. Explain the importance of lab techniques;
2. Describe basic laboratory techniques in disease diagnosis;
3. Perform lab examinations in veterinary hospitals/laboratories;
4. Demonstrate the general skill in laboratory and disease diagnosis in animal;
5. Apply technical skills in disease diagnosis investigation for proper treatment.

Course Contents

Theory

Unit 1: Common laboratory equipment and their functions **10 Hrs.**

1.1 Common terms related to lab equipment: e.g. sterilization, autoclaving, moist heat, dry heat, refrigeration, deep freezing, distillation etc.
1.2 Principle behind handling veterinary laboratory equipment
1.3 Functions and safety of laboratory and lab. equipment
1.4 Identification and differentiation of instrument, e.g. Microscope: (simple, compound and binocular), Autoclave, Incubator, Hot air oven, Refrigerator, Centrifuge, Distillation set, Water bath, pH Meter , Colorimeter and Weighing balance

Unit 2: General laboratory procedures **5 Hrs.**

2.1. Definition, importance and use of lab procedures, safety measure of lab procedure Sterilization, disinfectant and antiseptics Storage of chemicals, reagents and vaccines
2.2. Cold chain maintenance
2.3. Collection, dispatch and receiving of samples
2.4. Factors affecting laboratory procedures

Unit 3: Parasitology **7 Hrs.**

3.1. Definition of parasites and Parasitology
3.2. Common internal parasites of livestock and poultry
3.3. Terminology used in veterinary parasitology
3.4. Faecal sample collection
3.5. Faecal examination methods
3.6. Common external parasites of livestock and poultry
3.7. Skin scraping test

Unit 4: Hematology **8 Hrs.**

4.1. Introduction of blood and its constituents
4.2. Importance and function of blood
4.3. Precautions while taking and handling of blood samples
4.4. Types of blood cells
4.5. Blood sample collection methods
4.6. Total count of RBC Total count of WBC Differential count of WBC Collection of blood serum Hemoglobin estimation
4.7. Basic interpretation of data of blood test/analysis

Unit 5: Urine Analysis **2 Hrs.**

5.1. Urinary system
5.2. Terminologies used in urine analysis
5.3. Urine and its constituents
5.4. Urine sample collection, handling and dispatch
5.5. Routine examination of urine and result interpretation

Unit 6: Microbiology **10 Hrs.**

6.1. Definition of microbes and microbiology.
6.2. Merits and demerits of microbes and microbiology.
6.3. Preparation and storage of media
6.4. Sample collection, handling and dispatch for bacteriology
6.5. Inoculation of media from various types of specimen
6.6. Examination of culture
6.7. Bacterial colony morphology and bacterial morphology
6.8. Gram's staining methods
6.9. Antibiotic sensitivity test and its interpretation
6.10. Examination of milk CMT and result interpretation.
6.11. Milk culture for bacteria

Unit 7: Post-mortem examination of livestock and poultry **3 Hrs.**

7.1. Definition of post-mortem, time period of post-mortem
7.2. Anatomy and organs of livestock and poultry
7.3. Terminologies used in post-mortem Procedure of post-mortem of poultry, pigs and small ruminants
7.4. Importance of post-mortem, interpretation of post-mortem examination

Practical

Unit 1: Identify common veterinary laboratory equipment	1 Hr.
Unit 2: Operate the microscope	1 Hr.
Unit 3: Prepare and clean glassware	1 Hr.
Unit 4: Perform sterilization	1 Hr.

Unit 5: Use antiseptics	1 Hr.
Unit 6: Use disinfectants	1 Hr.
Unit 7: Identify Morphology of trematodes	1 Hr.
Unit 8: Identify Morphology of nematodes	1 Hr.
Unit 9: Identify Morphology of Cestodes	1 Hr.
Unit 10: Identify of parasite eggs by faecal examination	1 Hr.
Unit 11: Identify external parasites	1 Hr.
Unit 12: Identify mange mites by skin scraping test	1 Hr.
Unit 13: Collect blood	1 Hr.
Practical 14: Prepare blood smear	1 Hr.
Unit 15: Count total RBC	1 Hr.
Unit 16: Count total WBC	1 Hr.
Unit 17: Perform differential count of WBC	1 Hr.
Unit 18: Estimate hemoglobin	1 Hr.
Unit 19: Prepare blood serum	1 Hr.
Unit 20: Identify blood protozoa	1 Hr.
Unit 21: Perform routine examination of urine	1 Hr.
Unit 22: Prepare bacteriological media	1 Hr.
Unit 23: Inoculate bacterial samples	1 Hr.
Unit 24: Prepare pure culture	1 Hr.
Unit 25: Perform stocking of bacteria	1 Hr.
Unit 26: Identify bacteria through Gram's staining method identification of	1 Hr.
Unit 27: Perform antibiotic sensitivity test (AST)	1 Hr.
Unit 28: Examine milk by California Mastitis Test (CMT)	1 Hr.
Unit 29: Perform post-mortem (PM) examination of livestock	1 Hr.
Unit 30: Perform post-mortem (PM) examination of Poultry	1 Hr.

Reference books:

1. Dhakal, I.P. *Laboratory Manual on Veterinary Microbiology and Parasitology*. IAAS, Rampur.
2. Dhakal, I.P. *Laboratory Manual on Disease of Farm Animals.* IAAS, Rampur
3. Sah, N., & Jalen, P. *Laboratory Manual of dairy Science*
4. Sastry, G. A. (2016). *Veterinary Clinical Pathology.* CBS publisher and distributors Pvt. Ltd., New Delhi, India

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	Total
Unit Hours	10	5	7	8	2	10	3	45
Marks	15	10	15	15	5	15	5	80

Basics of Animal Product Technology - II

(Meat, Fish and Wool)

(AG3103AS**)**

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

Semester: I **Lecture: 3 hours/week**

Tutorial: hour/week

Practical: 2/2 hours/week

Lab: hours/week

Course Description

This course is designed to provide information on importance and status of meat, fish and wool industry in Nepal. The course provides concept of organic meat, fish and wool production, the course includes physico-chemical properties of meat and fish, nutritive value and phenomena of conversion of muscles to meat and fish. The course includes meat and fish processing and quality evaluation, methods of meat preservation and post slaughtering process of meat and fish. The course includes sheep production practices, Physico-chemical properties of fibers, grading and type of wool, testing and characteristics of wool and post shearing operations of fiber.

Course Objectives

After completion of this course students will be able to:

1. Describe the production and processing of meat, fish and wool;
2. Evaluate quality of meat, fish and wool;
3. Process meat, fish and wool for human use.

Course Contents

Theory

Unit 1: Introduction **4 Hrs.**

1.1 Meat and Wool Industry in Nepal
1.2 Meaning and terminology related to Meat & Wool Industry
1.3 Importance of Meat and Wool Industry in Nepal
1.4 Concept of organic meat and Wool production

Unit 2: Meat and its properties **4 Hrs.**

2.1 Composition of meat in brief
2.2 Nutritive value of meat brief
2.3 Structure of muscles and phenomenon involved in the conversion of muscle to meat
2.4 Physical and chemical properties of meat in brief.

Unit 3: Meat Processing and its quality evaluation **5 Hrs.**

3.1 Types of meat products in brief
3.2 Slaughtering practices of meat
3.3 Microbiology of meat in brief
3.4 Evaluation and grading of meat
3.5 Skin and hide processing

Unit 4: Meat Preservation methods **5 Hrs.**

4.1 Importance of meat preservation in Nepal
4.2 Chilling and freezing
4.3 Curing, smoking and dehydration
4.4 Canning and radiation
4.5 Meat cutting and packaging for marketing

Unit 5: Post Slaughtering Process of Meat **3 Hrs.**

5.1 Post-mortem examination
5.2 Uses of slaughtering by-products
5.3 HACCP for slaughtering house

Unit 6: Fish Processing, quality evaluation and processing **5 Hrs.**

6.1 Nutritive value to fish
6.2 Harvesting fish for human consumption
6.3 Fish processing methods
6.4 Fish processing and their procedures
6.5 Evaluation and grading of fish
6.6 Preservation of processed fish for human food

Unit 7: Sheep Production **4 Hrs.**

7.1 Sheep is useful as a Milk, Meat and Wool Production
7.2 Impact of climate and environmental stress on Sheep production
7.3 Improvement needed in management and feeding of Sheep

Unit 8: Physical and Chemical properties of fiber **4 Hrs.**

8.1 Properties of true wool
8.2 Physical properties of wool
8.3 Chemical properties of wool
8.4 Factors affecting the quality of wool

Unit 9: Grading and types of fiber **4 Hrs.**

9.1 Development of follicles in brief
9.2 Standard of fibers
9.3 Screening of qualitative wool on the basis of purity and non-purity characteristics
9.4 Selection and grading of wool

Unit 10: Testing and characteristics of qualitative fibers **4 Hrs.**

10.1 Different methods of measurement of fibers
10.2 Measurement of fiber dimension
10.3 Fiber surface morphology
10.4 Orientation degree of fiber
10.5 Microscopic examination of fiber

Unit 11: Post shearing operations **3 Hrs.**

11.1 Washing and Blending
11.2 Spinning and Carding
11.3 Weaving and Fulling and Finishing
11.4 Chemical finishes

Practical

Unit 1: Identify commonly used meat and wool processing equipment 1 Hr.
Unit 2: Prepare layout of slaughtering house and identify slaughtering procedures of animals 1 Hr.
Unit 3: Perform Post slaughtering evaluation and eating quality of meat 2 Hrs.
- 3.1 Perform post slaughtering evaluation like appearance, texture, marbling, WHC, structure of connective tissues, firmness etc.
- 3.2 Judge of eating quality like flavor, texture, tenderness, appearance, juiciness and sensory evaluation

Unit 4: Prepare comminuted and emulsified meat products e.g., Ham, Bacon, Sausage, Meat loaf, Dry meat 2 Hrs.
- 4.1 Prepare Ham and Bacon in lab
- 4.2 Prepare Sausages
- 4.3 Prepare Meat loaf and Dry meat

Unit 5: Identify the process of meat inspection and quality evaluation 2 Hrs.
Unit 6: Process and inspect quality of fish for human food
Unit 7: Identify quality of fibers and judge the wool 1 Hr.
Unit 8: Study development of follicle, related gland and secretion of fiber production 1 Hr.
Unit 9: Perform tests for identification of wool 1 Hr.
Unit 10: Identify wool made products, their market and trend in Nepal 1 Hr.
Unit 11: Judge Biosecurity in meat, fish, and wool processing units 1 Hr.
Unit 12: Visit to the meat, fish, and wool processing plant near by institute 1 Hr.

Reference books:

1. Warris, P.D. (2000). *Meat science: An introductory textbook*. CABI, Publishing, UK.
2. Sharma, B.D. (1999). *Meat and meat product technology*. Jaypee Brothers, Medical Publisher Pvt. Ltd., New Delhi, India.
3. Cutting, C.L. (2002). *Fish: Processing and preservation*. Vedams eBooks Pvt. Ltd., New Delhi, India
4. Crean, D., & Bastian, G. (1996). *Sheep and wool production (Practical Farming)*. Butterworth Architecture, Oxford, UK.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	Total
Unit Hours	4	4	5	5	3	5	4	4	4	4	3	45
Marks	5	5	5 or 10	5 or 10	5	5 or 10	5	5	5	5	5	80

Fundamentals of Animal Waste Management

(AG3104AS**)**

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

Semester: I **Lecture: 3 hours/week**

Tutorial: hour/week

Practical: 2/2 hours/week

Lab: hours/week

Course description:

This course is designed to provide knowledge on agricultural waste, their utilization and management, insight on opportunities and challenges of animal waste management, its impact on environment. The course comprises of principles of agriculture and livestock waste management systems, components livestock waste management systems, types of livestock waste, their handling, nutrient recycling, and knowledge about the formulation of waste management plan.

Course objectives:

After completion of this course students will be able to:

1. Design animal waste management systems with an emphasis on systems for livestock and poultry operations;
2. Develop an animal waste management system that manages the waste from its production through its utilization;
3. Utilize the total systematic approach to animal waste management systems;
4. Perform animal waste treatment and apply solid animal waste in the soil.

Course contents

Theory

Unit 1: Animal waste concept, generation, utilization, and management 6 Hrs.

1.1 Introduction of animal waste, definition, and waste classification

1.2 Animal waste generation
- 1.2.1 Waste from cultivation activities
- 1.2.2 Waste from livestock and Poultry production
- 1.2.3 Waste from Aquaculture

1.3 Waste utilization routes
- 1.3.1 Fertilization
- 1.3.2 Anaerobic digestion
- 1.3.3 Absorbents in the elimination of heavy metals
- 1.3.4 Pyrolysis
- 1.3.5 Animal feed
- 1.3.6 Direct combustions

Unit 2: Animal waste: Opportunities and Challenges 3 Hrs.

2.1 Principles associated with manure management

2.2 Generation of energy and the nutrient from the animal waste

2.3 Livestock waste and its impact on the environment: effect of waste on water, air, soil and animal resources followed by geology and ground water considerations

2.4 Pathogens in animal waste and the impact of waste management practices

Unit 3: Animal waste management plan **8 Hrs.**

3.1 Waste management plan definition, components of animal waste management systems, concepts of nutrient recycle, essential steps involved in waste management plan

3.2 The common methods of solid waste disposal: Open dumps, Sanitary landfills, drainage, Incineration and Composting

Unit 4: Principles of animal waste management systems **3 Hrs.**

4.1 "R" approach to AWM

4.2 Reduce the quantity and ill effects of waste generation by reducing the quantity of waste

4.3 Reusing the waste products with simple treatments

4.4 Recycling the waste by using it as a resource to produce same or a modified product

Unit 5: Importance of livestock waste management **3 Hrs.**

5.1 Livestock waste and its advantages and disadvantages in the agricultural systems

5.2 Sources of livestock waste

5.3 Characteristics of animal manure

Unit 6: Types of livestock waste **4 Hrs.**

6.1 Solid waste (Dung, wasted feeding materials and soiled bedding materials)

6.2 Liquid waste (Urine and washed water)

Unit 7: Collection of livestock waste and the methods **3 Hrs.**

7.1 Separate collection: solid and liquid waste

7.2 Flushing of both types of waste

Unit 8: Traditional Methods of livestock waste management along with their methods, advantages and disadvantages **5 Hrs.**

8.1 Dung cakes

8.2 Dumping in to heaps or pits

8.3 Composting

8.4 Direct application in the fields

Unit 9: Advanced methods of livestock waste management **10 Hrs.**

9.1 Solid waste management

- 9.1.1 Bio-gas production
- 9.1.2 Vermicomposting
- 9.1.3 Pyrolysis
- 9.1.4 Soldier fly breeding: Black soldier fly larvae or grubs
- 9.1.5 Poultry litter management: Production of waste from poultry farm, collection, storage, treatment, and utilization

9.2 Liquid waste management: Ammonia recycling

9.3 Carcass disposal

- 9.3.1 Concept and classification of carcass and dead animal disposal
- 9.3.2 Burial methods
- 9.3.3 Burning
- 9.3.4 Electric incinerators

9.4 Composting

Practical

1. Identify the various types of farm waste and refuses 1 Hr.
2. Identify the ways of disposal of farm sewage and farm refuses 1 Hr.
3. Estimate farm waste from organized as well as small scale livestock farms 1 Hr.
   1 Hr.
4. Identify the ways of disposal for carcass and dead animal 1 Hr.
5. Collect and dispose liquid farm wastes 1 Hr.
6. Collect and dispose of solid farm wastes 1 Hr.
7. Collect and transport farm waste 1 Hr.
8. Prepare compost of farm wastes (manure, dead animals, etc.) 1 Hr.
9. Observe process and advantages of bio-gas plant 1 Hr.
10. Prepare Bio-fertilizer from farm wastes 1 Hr.
11. Observe rendering: a method to recycle farm waste resources 1 Hr.
12. Perform farm disinfection and biosecurity
13. Manage farm wastes for effective fly and rodents control
14. Identify health implication of farm wastes
15. Visit to nearest water recycling and purification plant

Reference books:

1. Awan, A. N., & Khan, F. H. (2017). *Farm waste management and disposal systems*. University of Agriculture, Faisalabad, Pakistan.
2. Loehr, R. (1974). *Agricultural waste management, problems, processes, and approaches* (1st ed.). Academic Press.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	Total
Unit Hours	6	3	8	3	3	4	3	5	10	45
Marks	10	5	15	5	5	5	5	10	20	80

Agriculture Extension and Communication

(AG3105PS)

Year: III **Total: 6 hours /week**
Semester: I **Lecture: 4 hours/week**
Tutorial: hour/week
Practical: 2 hours/week
Lab: hours/week

Course description:
This course is designed to provide the knowledge and skills on different types and forms of education, their philosophy, principles, objectives, process and practices. This course will help to develop students' understandings and ability to apply the knowledge of agricultural extension system. This course also studies teaching and learning process, communication process, rural leadership development and farmers' training in agriculture extension.

Course objectives:
After completion of this course, the students will be able to:

1. Explain importance of education and extension education and extension service;
2. Explain principle, philosophy, teaching and learning in agricultural extension;
3. Apply the knowledge of extension education in TOT, program planning, monitoring and evaluation of agricultural extension programs;
4. Communicate effectively with individuals and group in variety of setting by using different means of communication.
5. Apply the leadership styles in different set of community situation while designing, implementing and evaluating the extension program;
6. Apply the knowledge of teaching learning theory, laws of learning and teaching methods in different context and situation of adult learning.

Course Contents:

Theory

Unit: 1 Introduction to Education: 3 Hrs.

1.1. Meaning, concept and definition of education, and behavior change
1.2. Types of education: Formal, non-formal and informal
1.3. Role and importance of education in rural development

Unit: 2 Extension Education System in Nepal 10 Hrs.

2.1 Meaning, concept, origin and history of extension education
2.2 Objective, area and scope of extension education
2.3 Principles of extension education
2.4 Need and importance of extension education.
2.5 Historical development of agricultural extension in Nepal
2.6 Current Organizational structure of Agriculture and Livestock Development (central, provincial & local govt)
2.7 agricultural Extension system and approaches used in Nepal
2.8 Present extension system used in Nepal

Unit: 3 Teaching and learning process 10 Hrs.

3.1 Meaning and concept of teaching and learning

3.2 Elements and steps of teaching learning process
3.3 Theory of learning, Principles of learning and law of learning
3.4 Factor affecting adult learning
3.5 Extension teaching method: meaning concept and classification of teaching methods
3.6 Extension teaching methods: Individual, Group, Mass method/contact
3.6 Audio-visual aids – Meaning, concept, nature and classification
3.7 Factors of consideration while selecting the teaching methods

Unit: 4 Communication process 12 Hrs.

4.1 Meaning and definition of communication, elements of communication
4.2 Basis of classification and types of communication
4.3 Development communication, meaning and concept ole of communication in development
4.4 Function of communication in extension work
4.5 Principles of communication
4.6 Models of communication process
4.7 Types of communication channels
4.8 Barriers of communication
4.9 Feedback system of communication in communication process
4.10 ICT in agriculture: use, types function in Nepalese context and situation

Unit 5: Transfer of technology 5 Hrs.

5.1 Meaning of technology and transfer of technology, horizontal and vertical technology transfer
5.2 Meaning and concept of adoption, diffusion and innovation, difference between adoption and diffusion, attributes of technology
5.3 Adoption process,
5.4 Adopters category and their characteristics
5.5 Factor affecting adoption of innovation in decision making process

Unit 6: Program planning, monitoring and evaluation in extension 6 Hrs.

6.1 Meaning, concept and importance of program, planning and program planning.
6.2 Principle of program planning, types of program planning
6.3 Basic Steps in program planning of extension program
6.4 Program planning process in federal, provincial and local level govt
6.5 Meaning and concept of monitoring and evaluation of extension program
6.6 Designing an evaluation plan Basic steps in evaluating extension program

Unit: 7 leadership development 6 Hrs.

7.1 Meaning, concept, type of leader and leadership
7.2 Basic elements and importance of leadership in extension
7.3 Qualities/characteristics, role leader in community development
7.4 Selection and development of local leader

Unit: 8 Farmers' training 5 Hrs.

8.1 Concept and definition of training, need of farmers training
8.2 Capacity and need assessment of farmers training
8.3 Designing and planning of farmers training Process of training
8.4 evaluating the training program
8.5 Development and management of training program

Unit: 9 Motivation **3 Hrs.**

9.1 Meaning, concept and definition of motivation
9.2 Purpose and process of motivation
9.3 Factor affecting motivation
9.4 Techniques of motivation

Practical

Practical	Topic	Time
Unit 1:	Visit farming community and farmer's group and observe the scale of production types of farming, farming plan, components of farming	6 Hrs.
Unit 2:	Prepare individual level farm production plan i) crop production ii) livestock production	2 Hrs.
Unit 3:	Visit, observe and interact with agriculture extension offices/veterinary hospital and livestock service expert center and study their organizational mechanism	8 Hrs.
Unit 4:	Conduct farmers training need	2 Hrs.
Unit 5:	Prepare pamphlet, leaflets and folders	2 Hrs.
Unit 6:	Prepare radio/TV script, folk song, and one act drama	2 Hrs.
Unit 7:	Participate and observe in fair, exhibition, field day and field tour	2 Hrs.
Unit 8:	Conduct method demonstration	2 Hrs.
Unit 9:	Conduct result demonstration	2 Hrs.
Unit 10:	Prepare a training program	2 Hrs.

Reference books:

1. Ban, A.W., Den, V., & Hawkins, H.S. (1998). *Agricultural extension*. K. Jain for CBS Publishers and Distributors, New Delhi, India.
2. Bhusan, V., & Sachdeva, D.R. (1994). *An introduction to sociology*. Kitab Mahal, Allahabad.
3. Chitambar, J. V. (1973). *Introductory rural sociology*. Wiley Eastern Ltd., India.
4. Dongol, B. B. S. (2004). *Extension education*. Pratima Singh Dongol, Kathmandu, Nepal.
5. Mathialagan, P. (2007). *A textbook of animal husbandry & livestock extension*. International Book Distributing Co., Lucknow, India.
6. Nakkiran, S., & Ramesh, G. (2010). *Research method in rural development*. Deep and Deep Publication Pvt. Ltd., New Delhi, India.
7. Sandhu, A. A. (1993). *A textbook of communication process and method*. Raju Primlani for Oxford & IBH Publishing Company Pvt. Ltd., New Delhi, India.
8. Shankar Roa, C. N. (2011). *Sociology: Principle of sociology with an introduction to social thought*. S. Chand & Company Ltd., New Delhi, India.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	Total
Unit Hours	3	10	10	12	5	6	6	5	3	60
Marks	2.5	15	15	15	5	10	10	5	2.5	80

Agribusiness, Marketing and Cooperative

(AG3106PS**)**

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

Semester: I **Lecture: 2 hours/week**

Tutorial: hour/week

Practical: 2/2 hours/week

Lab: hours/week

Course description:

This course is designed to provide the knowledge on agribusiness management, agribusiness environment, organization, management function and human resource development, investment appraisal criteria, business risk and uncertainty. The course also introduces cooperatives and their significance in agriculture. On the marketing part of course, it covers introduction to agricultural marketing, marketing function, and marketing channel and marketing efficiency, supply chain, value chain and government intervention.

Course objectives:

After completion of this course students will be able to:

1. Describe general concept of agribusiness and cooperatives with relation to production, distribution, marketing and consumption;
2. Appraise the investment in agriculture project;
3. Locate business risk and their management strategies;
4. Identify market linkage and market functions of different market actors;
5. Explain the effect of government intervention;
6. Calculate market efficiency.

Course Contents:

Theory

Unit 1: Introduction to Agribusiness Management: 2 Hrs.

1.1. Concept and definition of agribusiness and agribusiness management
1.2. Scope of agribusiness
1.3. Importance of agribusiness
1.4. Problem and prospects of agribusiness development in Nepal

Unit 2: Basic Concept of Firm, Plant and Industry: 2 Hrs.

2.1 Concept of firm, plant and industry
2.2 Interrelationship between firm, plant and industry

Unit 3: Agribusiness Environment: 1 Hr.

3.1 Business enabling environment

Unit 4: Organization, Management Function & Human Resource Development: 2 Hrs.

4.1 Organization and function of organization
4.2 Business management function
4.3 Managerial decision process in agribusiness
4.4 Human resource development and its function

Unit 5: Investment Appraisal Criteria 3 Hrs.

5.1 General concept of different discounting criteria of investment appraisal
5.2 General concept of different non-discounting criteria of investment appraisal

Unit 6: Risk and Uncertainty: **2 Hrs.**

6.1 Concept of risk and uncertainty and their types
6.2 Management of business risk

Unit 7: Cooperative: **3 Hrs.**

7.1 Definition, principle and objectives of cooperative
7.2 Cooperative farming and its importance
7.3 Cooperative marketing and its importance
7.4 Role of cooperative in agriculture commercialization

Unit 8: Introduction to Agricultural Marketing: **3 Hrs.**

8.1 Concept of agricultural market and marketing.
8.2 Importance and problem of agri-marketing
8.3 Marketing vs selling approach
8.4 Difference between marketable surplus and marketed surplus
8.5 Market intermediaries

Unit 9: Marketing Functions **3 Hrs.**

9.1 Primary function: assembling, processing and dispersion
9.2 Secondary Function: standardization and grading, packaging, transportation, storage, financing, risk bearing and selling
9.3 Marketing function given by Kohls and Uhl.

Unit 10: Marketing Channel and Marketing Efficiency **3 Hrs.**

10.1 General marketing channels of major crops and livestock products
10.2 Price spread and producers share
10.3 Marketing Efficiency: technical, operational and price efficiency

Unit 11: Supply chain and value chain **3 Hrs.**

11.1 Concept of Value Chain, Supply Chain, Backward and Forward Linkage
11.2 Supply chain management: concept, definition and importance
11.3 Value addition in the product and factors affecting in value addition of the product
11.4 Value chain map

Unit 12: Basic concept on government intervention in production and marketing 3 Hrs.

12.1 Floor price and its effect
12.2 Ceiling price and its effect
12.3 Taxation and its effect
12.4 Subsidies and its effect

Practical

Unit 1: Describe management structure, activities, business environment, investment, profit and risk of agribusiness firm/company / cooperative. 2 Hrs.
Unit 2: Identify major institutions and their roles related to agricultural product markets in Nepal. 2 Hrs.
Unit 3: Appraise financial status of agriculture project by discounted criteria (NPV, B/C ratio, IRR) and non-discounted criteria (PBP, SRR, ROI). 3 Hrs.
Unit 4: Identify major business risk and safeguard majors. 1 Hr.
Unit 5: Discover value chain map, backward linkage and forward linkage of HVC's. 2 Hrs.

Unit 6: Estimate production and marketing cost of any HVC at various chain level and calculate price spread, producer's share and market efficiency. 3 Hrs.

Unit 7: Identify various marketing functions operated by the market intermediaries (collector, trader, processor) 2 Hrs.

References:

1. Acharya, S.S. & Agarwal, N.L. (2011). *Agricultural marketing in India* (5th ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Pandey, M., & Tewari, D. (2010). *The Agribusiness book: Marketing and value chain perspective*. IBDC Publisher, New Delhi.
3. Broadway, A.C., & Broadway-Arif, A.A. (2008). *Textbook of agribusiness management*. Kalyani Publisher, New Delhi, India.
4. 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	Total
Unit Hours	2	2	1	2	3	2	3	3	3	3	3	3	30
Marks	5		5 or 10			5 or 10		5 or 10		10 or 15			40

Introductory Animal Welfare and Jurisprudence

(AG3107AS**)**

Year: III **Total: 3 hours /week**
Semester: I **Lecture: 3 hours/week**
Tutorial: hour/week
Practical: 0 hours/week
Lab: hours/week

Course description:

This course is designed to provide basic concepts about the animal welfare, importance of animal welfare in livestock arming, ethical concerns of welfare, interaction of humans with animals, animal-human abuse link, role of technicians in animal welfare, responsible animal owners, prevention and protection of cruelty to animals. This course also provides the knowledge of legal duties of technicians, animal legislations, important Livestock/Veterinary acts, regulations and standards of Nepal.

Course objectives:

After completion of this course students will be able to:

1. Understand the concept of animal welfare with the context of five freedom and understand several aspects of animal welfare;
2. Understand the basic idea about ethics, duties and legal provision related to veterinary practices as well as important acts, regulations and standards of Nepal.

Course Contents
Theory

Unit 1: Concepts in Animal Welfare **2 Hrs.**

1.1 Introduction and importance of animal welfare in domestic farming
1.2 Animal behavior and animal welfare

Unit 2: Applying animal welfare: in farming practices **3 Hrs.**

2.1 Behavioral measures of animal welfare
2.2 Disease and production measures of animal welfare
2.3 Assessing welfare in practice

Unit 3: Animal Welfare Management **4 Hrs.**

3.1 Diet, feeding and animal welfare
3.2 Livestock: slaughter and killing animals for disease control purposes
3.3 Euthanasia and emergency killing
3.4 Welfare of working animals
3.5 Animal welfare during transport and at markets

Unit 4: Society and animal welfare **5 Hrs.**

4.1 Religion and animal welfare
4.2 Human conflict and animal welfare
4.3 Human animal interactions
4.4 Economics and animal welfare
4.5 Role of the technicians in animal welfare

4.6 Animal welfare under disaster

Unit 5: Livestock Services and Institutions in Nepal **3 Hrs.**

5.1 World Organization for Animal Health (OIE)
5.2 Important Guidelines of OIE
5.3 Codex of OIE
5.4 Global strategy for animal disease control

Unit 6: National visions and policies of livestock sector **5 Hrs.**

6.1 Livestock and veterinary services in Nepal's constitution
6.2 Livestock and veterinary related issues in *Muluki Ain*
6.3 National Livestock Policy of Nepal
6.4 Prospects of livestock sector in National Plans
6.5 Livestock Development Strategy

Unit 7: Laws and regulations related with veterinary services **15 Hrs.**

7.1 Animal Health and Livestock Services Act, 2055 and its regulation
7.2 Animal Slaughterhouse and Meat Inspection Act 2055 and its regulation
7.3 Nepal Veterinary Council Act 2055 and its regulation
7.4 Feed Act, 2033 and its regulations
7.5 Food Act, 2023 and its regulations

Unit 8: Directives and guidelines of livestock sector of Nepal **4 Hrs.**

8.1 Directives and guidelines of livestock services in Nepal
8.2 Bird Flu control order
8.3 Farm establishment guidelines
8.4 Live animal transport guidelines

Unit 9: Introductions to commonly used surgical instruments **4 Hrs.**

9.1 Livestock services system in Nepal
9.2 Animal quarantine in Nepal
9.3 Insurance of Livestock
9.4 Banking and Finance policies towards livestock sector

References:

1. Fraser, D.M., & Fraser, A.F. (2007). *Domestic animal behavior and welfare* (4th ed.). CABI publishers.
2. World Society for Animals, (2007). *Concepts in animal welfare: Animal welfare syllabus* (CD ROM format). London: University of Bristol and WSPA. https://www.worldanimalprotection.org/animal-welfare-training-resources
3. *Veterinary Chaumasik*, Compendium of Nepal legislations, Nepal Veterinary Association.
4. Nepal Law Commission, Department of Livestock Services/Nepal and Nepal Veterinary Council.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	Total
Unit Hours	2	3	4	5	3	5	15	4	4	45
Marks	5	5	5	5 or 10	5	5 or 10	25	5	5	80

Basics of Farm Housing and Biosecurity

(AG3108AS**)**

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

Semester: I **Lecture: 3 hours/week**

Tutorial: hour/week

Practical: 2/2 hours/week

Lab: hours/week

Course description:

This course is designed to provide basic knowledge on livestock housing for different rear livestock species and farm biosecurity. Basically, the course covers pertinent aspects on livestock housing covering cattle and buffalo housing, housing of goats, sheep housing and pigs housing. The course also provides knowledge on issues related to livestock housing and environment. The course also includes major reflection of environment to the livestock-climate influence, livestock and climate change, environment and animal wellbeing, strategies to reduce the impact of heat and cold stress and effect of environment on animal health, immune functions and metabolism.

Course objectives:

After completion of this course students will be able to:

1. Explain common livestock housing systems and their functions;
2. Explain impact of environment and housing requirement;
3. Explain environmental concerns to livestock including climate change, animal wellbeing and strategies to reduce the adverse impact of climate variability to the livestock;
4. Explain the importance of farm hygiene and biosecurity

Course Contents

Theory

Unit 1: Introduction to the housing management and farm biosecurity 6 Hrs.

1.1 Concept and terminology of housing management and farm biosecurity
- 1.1.1 Concept of housing management
- 1.1.2 Commonly used terms in animal housing systems

1.2 Provide knowledge on housing systems and related details, maintaining farm biosecurity
- 1.2.1 Requirements of housing systems
- 1.2.2 Major livestock species
- 1.2.3 Factors related to housing management

Unit 2: Cattle/buffalo housing 4 Hrs.

2.1 Explain common housing systems of cattle and buffaloes
- 2.1.1 Types of housing
- 2.1.2 Loose house barn and other provisions

2.2 Provide basic knowledge on cattle and buffalo housing systems
- 2.2.1 Cattle shed
- 2.2.2 Buffalo shed
- 2.2.3 Shed for calves
- 2.2.4 Advantage of tail to tail and face to face systems

Unit 3: Other details of cattle/buffalo housing **4 Hrs.**

3.1 Floor requirements and stall design
3.2 Walls and roof conditions
3.3 The stanchion stall; tie stall
3.4 Manger, alleys and requirements
3.5 Manger gutter
3.6 Calving boxes and isolation boxes
3.7 Sheds for young stocks, bull and bullock sheds

Unit 4: Housing of Goats **4 Hrs.**

4.1 Housing, shed orientation and shed dimension
4.2 Roof, ventilation management
4.3 Important consideration for construction of goat shed
4.4 Shed for kids rearing and manure disposal

Unit 5: Sheep housing **4 Hrs.**

5.1 Types of housing
5.2 Scale of rearing and housing determinants
5.3 Semi-open; grazing provision
5.4 Extensive-confined
5.5 Extensive-confined with housing overnight
5.6 Intensive-confined
5.7 Young ones care and housing management

Unit 6: Pig housing **4 Hrs.**

6.1 Types of pig holding and scale of rearing
6.2 Selection of housing locations
6.3 Construction plan for a good pig house/shed
6.4 Space requirements for different purpose of pig rearing
6.5 Different models/types of pig house house/shed
6.6 Housing arrangement for new born and growing ones

Unit 7: Climate influence on livestock productivity **3 Hrs.**

7.1 Climate influence on livestock productivity
7.2 Environmental effects and energy requirements
7.3 Heat stress, ambient temperature, relative humidity, radiant energy and wind speed

Unit 8: Livestock and climate change **3 Hrs.**

8.1 Introduction
8.2 Segments of atmosphere
8.3 Methane gas generation and adaptive measures
8.4 Emission of methane gas from dung and manure
8.5 Adaptive techniques of methane gas and management

Unit 9: Environment and animal well-being **2 Hrs.**

9.1 Introduction
9.2 Animal well-being and stress management
9.3 Well-being audits include measures of environment
9.4 Animal welfare and proper handling

Unit 10: Strategies to reduce the impact of the heat and cold stress **4 Hrs.**

10.1 Importance of shade in stress management
10.2 Water availability and management
10.3 Cooling the milk center
10.4 Reducing heat and cold stress in different types of housing
10.5 Cold stress and warming effect
10.6 Monitoring heat stress on commercial dairies

Unit 11: Effect of environment on animal health and production **3 Hrs.**

11.1 The issue of environment-health interactions
11.2 Thermodynamics and the biology of rearing
11.3 Environmental parameters and their effects on animal health
11.4 Environmental impact on feed intake and animal production

Unit 12: Farm Hygiene and Biosecurity **4 Hrs.**

12.1 Introduction of farm hygiene and biosecurity
12.2 Disinfections and Sanitation. Commonly used disinfectants and their doses
12.3 Practice of farm biosecurity to prevent diseases
12.4 Methods of biosecurity adopted at wet market, transportation and waste disposal areas.
12.5 Plan for the farm biosecurity

Practical

Unit 1: Introduction to the concept of dairy housing **3 Hrs.**

1.1 Provide pertinent knowledge on dairy housing
1.1.1 Theoretical orientation of the concept
1.1.2 Demonstrate models and fact sheet on housing
1.2 Explore dairy housing knowledge-based system
1.2.1 Specimens, photographs and visuals

Unit 2: Practices on dairy cattle/buffalo housing designing **3 Hrs.**

2.1 Provide basic information on the lay-out and design of dairy cattle and buffalo housing
2.1.1 Theoretical orientation
2.1.2 Sample of housing design/specimen
2.1.3 Requirements
2.1.4 Designing
2.1.5 Drawing houses with different dimensions and requirements

Unit 3: Practices on sheep and goat housing designing **3 Hrs.**

3.1 Provide basic information on the lay-out and design of sheep and goat housing
3.1.1 Theoretical orientation
3.1.2 Sample of housing design/specimen
3.1.3 Requirements
3.1.4 Designing
3.1.5 Drawing houses with different dimensions and requirements

Unit 4: Practices on pig housing designing **3 Hrs.**

4.1 Provide basic information on the lay-out and design of pig housing

4.1.1 Theoretical orientation
4.1.2 Sample of housing design/specimen
4.1.3 Requirements
4.1.4 Designing
4.1.5 Drawing houses with different dimensions and requirements

Unit 5: Exploration of livestock housing and environmental issues 3 Hrs.

5.1 Provide basic information on environmental issues in relation to livestock housing considering stress management and livestock well-being
5.1.1 Theoretical orientation
5.1.2 Discussion about environmental issues and livestock rearing
5.1.3 Photographs study
5.1.4 Display of related information posters and videos
5.1.5 Discussion

Text and Reference books

1. Banerjee, G.C. (2000). *A textbook of Animal Husbandry* (8th ed.). Oxford and IBH Publishing Pvt. Ltd., India.

2. Bartali, H. (1999). *Handbook of agricultural engineering* (Vol. II). American Society of Agricultural and Biological Engineers, Michigan, USA.

3. Collier, R.J. & Collier, J.L. (2012). *Environmental Physiology of Livestock*. John Wiley & Sons. DOI. 10.1002/9781119949091

4. FAO, (1999). *Farmers handbook on pig production (for the small holders at village level)*. FAO, Rome, Italy.

5. Joshi, B.R. & Shrestha, B.S. (2003). *The goats, their production and health management* (1st ed.). Agricultural Research Station, Kaski, Pokhara, Nepal.

6. Upreti, C.R., Kushbuwa, B.P., & Upreti, S. (2012). *Cattle and buffalo husbandry technology in Nepal*. Agricultural Research Council, Khumaltar, Lalitpur, Nepal.

7. Dewulf, J., & Immerseel, F.V. (2020). *Biosecurity in animal production and veterinary medicine, from principles to practice*. CABI.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	12	Total
Unit Hours	6	4	4	4	4	4	3	3	2	4	3	4	45
Marks	10	5 or 10	5 or 10	5 or 10	5 or 10	5 or 10	5	5	5	5 or 10	5	5 or 10	80

Third Year/ Second Semester

Elementary Agricultural Statistics

(AG3201PS**)**

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

Semester: II **Lecture: 2 hours/week**

Tutorial: 1 hour/week

Practical: hours/week

Lab: hours/week

Course description:

This course is designed to provide basic knowledge on Statistics, oriented to agricultural and livestock production. The first part of the course covers descriptive statistics and the second part covers inferential statistics. The course provides the skills on the application of basic statistical methods to agricultural sciences. The entire course deals with assessing, acquiring, and developing statistical knowledge, attitude, skills and tools that are necessary to agricultural research at elementary state.

Course objectives:

After completion of this course students will be able to:

1. Understand the concept of fundamentals of statistics;
2. Explore elementary statistical methods to collect, organize, present and interpret agricultural data in a scientific way;
3. Distinguish between descriptive statistics and inferential statistics;
4. Apply statistical methods through computer application to describe, and analyze agricultural data to draw inferences about the population and
5. Manage agricultural data for their future use.

Course Contents:

Theory

Unit 1: Introduction to Statistics & the fundamentals **2 Hrs.**

1.1. Introduction, origin, meaning, definition and uses of statistics, role of statistics in agricultural research, limitations and abuses of statistics.

1.2. Variables, measurement of scale, statistical notations, population, sample, parameter, statistics, sampling distribution and standard error.

Unit 2: Organization of Data **2 Hrs.**

2.1. Organization of data, ordered array, frequency distribution, purpose of frequency distribution, frequency distribution of grouped data

2.2. Exclusive and inclusive type of classification, converting inclusive type of classification into exclusive type, mid values and the class boundaries, principles of classification, guidelines to classify data

Unit 3: Presentation of Data **2 Hrs.**

1.1. Statistical diagrams, simple bar diagram, sub-divided bar diagram, percentage bar diagram, multiple bar diagram

1.2. Pie-chart, frequency curves and ogives

Unit 4: Measurement of Central Tendency **2 Hrs.**

4.1. Introduction, characteristics of good measures of central tendency, mean, median, and mode

4.2. Characteristics and uses of mean, median and mode in real life

Unit 5: Measures of Dispersion **2 Hrs.**

1.1. Meaning, purpose and definition of dispersion statistics, absolute and relative measures of dispersion

1.2. Commonly used measures of dispersion: range, quartile deviation, mean deviation, mean squared deviation, variance, standard deviation and coefficient of variation.

Unit 6: Measures of Shape **2 Hrs.**

1.1. Skewness, positively and negatively skewed curves, Karl Pearson's coefficient of skewness

1.2. Kurtosis, leptokurtik, mesokurtik and platy kurtik curves

Unit 7: Probability Theory **4 Hrs.**

1.1. Methods of counting: factorial rule, permutation, combination, experiment, random experiment, outcomes and sample space, total possible cases and favorable cases in a random experiment, definition of probability

1.2. Events: equally likely events, mutually exclusive events, exhaustive events, independent events, sure event, impossible event.

1.3. Additional rule of probability, multiplication rule of probability, conditional probability

1.4. Definition of probability distribution [no details are to cover. only a conceptual introduction to probability distribution], characteristics of a probability distribution

Unit 8: Correlation and Regression Analysis **2 Hrs.**

8.1. Concept of correlation, types of correlation

8.2. Estimation of correlation through scatter diagram, Karl Pearson's coefficient of correlation, coefficient of determination, interpretation of correlation coefficient, and properties of correlation coefficient

8.3. Concept of regression, simple linear regression, properties of regression coefficients, relation between correlation coefficient and regression coefficient.

Unit 9: Introduction to Sampling Theory **2 Hrs.**

9.1. Meaning and importance of sampling

9.2. Probability sampling: simple random sampling, stratified sampling, systematic sampling, cluster sampling and multistage sampling.

9.3. Non-probability sampling: convenience sampling, quota sampling, judgments sampling and characteristics of a good sample

Unit 10: Hypothesis Testing **7 Hrs.**

10.1. Concept of hypothesis testing: null and the alternate hypothesis,

10.2. Errors in hypothesis testing, Type-1 Error, Type-2 Error, test statistics, decision rule for a hypothesis testing

10.3. Basics of large sample tests: Z-test, One-sample Z-test for mean, Two-sample Z-test for means.

10.4. Small sample tests: one-sample t-test for mean, two independent sample t-test for sample means, t-test for dependent sample Mean (Paired-T Test).

10.5. Chi-square test of goodness of fit, chi-square test for test of independence of factors

Unit 11: Analysis of Variance **3 Hrs.**

11.1. Introduction, logic behind analysis of variance, F-test
11.2. Introduction to experimental designs.

References

1. Agrawal B.L. 1996. Basic statistics (3rdedition), New Age International Pvt. Ltd. New Delhi.Chandel, S.R.S. 1984. A hand book of agricultural statistics. Achal Prakashan Mandir, Kanpur, India.
2. Dhakal, C.P. (2018). A reference manual of statistics for graduate students in agriculture and all-time researchers. IAAS, Post Graduate Campus, Tribhuvan University, Kirtipur, Kathmandu.
3. Dhakal, C.P. 2013. Elementary Statistics in Agriculture and Environmental Sciences. Sajha Prakashan. Lalitpur, Nepal.
4. Gupta S.C. and V.K. Kapoor. 1998. Fundamentals of applied statistics, Chand and Com. New Delhi. Singh, S. and R.P.S. Verma. 1982. Agricultural Statistics, Rama Publishers Meerut.
5. Tripathi, P.N. 1991. A manual on introductory agricultural statistics, Tribhuvan University, IAAS, Chitwan, Nepal.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	Total
Unit Hours	2	2	2	2	2	2	4	2	2	7	3	30
Marks	5		5		5		5	5		10	5	40

Social Mobilization and Community Development

(AG3202PS**)**

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

Semester: II **Lecture: 3 hours/week**

Tutorial: hour/week

Practical: 2 hours/week

Lab: hours/week

Course description:

This course will enable the students to select and apply the most appropriate process, approaches and techniques in developing rural and community development programs by appreciating the importance of socially organized groups and their mobilization in the development activities. This course will help to develop students' understandings and ability to learn about contemporary agriculture and process of urbanization. This course will also enable the students to make the wise use of gender concept and issues related to development in most relevant ways.

Course objectives:

After completion of this course, the students will be able to:

1. Explain the different sociological concept and terminology;
2. Explain the term social mobilization, it's history, types, approaches, models and strategy;
3. Identify the scope, role in different Civil society, GOs & NGOs on community development;
4. Explain the concept of group, their typology, importance and group formation procedure;
5. Develop the knowledge and skills in identifying social problems;
6. Explain co-operation, conflict, situation for conflict, conflict management or resolution technique;
7. Describe and compare WID, WAD and GAD.

Course Contents:

Theory

Unit: 1 Basic sociological concept **15 Hrs.**

1.1. Meaning, concept and definition of sociology and rural sociology
1.2. Natures of sociology: Sociology is a science
1.3. Importance of rural sociology in agricultural extension and rural development
1.4. Sociological concept and terminology: society and culture,
1.5. Society, community, state and nation.,
1.6. Social Institution – Family and marriage system,
1.7. Social institution: Religion, economic, educational and political institution
1.8. Social value, belief, norms, taboos, rituals custom, tradition
1.9. Caste and ethnicity, race of Nepal
1.10. Social structure: role, status, position, power and prestige
1.11. Socialization, social stratification
1.12. Meaning and factor of social change
1.13. Social problems and means of remedies
1.14. Meaning and cause of social movement

1.15. Meaning and concept of social process, classification of social process universal and derived social process

Unit: 2 Social mobilization and community development 12 Hrs.

2.1 Meaning, concept, purpose and history (in Nepal) of social mobilization
2.2 Lesson learned from the past experience from social mobilization
2.3 Meaning and concept of development,
2.4 Rural and community development: Approaches, strategies and types
2.5 Decentralization: Concept, types, principles, advantages and disadvantages
2.6 Federalism for development: Nepalese experiences
2.7 Local governance: Past experience, Local Governance Operation Act 2017,
2.8 Role of Local agencies, community-based Organization and NGOs in social mobilization
2.9 Concept and principle of sustainability development
2.10 A brief overview of efforts and approaches of rural development in Nepal over the last decades
2.11 Issues and problems of rural development in Nepal

Unit: 3 Group formation and group dynamics 12 Hrs.

3.1 Meaning, concept, type and importance of group, why do people join in the group
3.2 Group formation procedure, process and group dynamics
3.3 Natures of social group and group properties
3.4 History of group approach of community development and extension
3.5 Meaning, concept, definition of conflict and its management in social group
3.6 Transition of conflict thought, situation for conflict, conflict intensity continuum
3.7 Measurement of conflict) and conflict management technique
3.8 Social facilitation process: social facilitation, social loafing, group shift, social influence
3.9 Functional group formation: Guideline and rules of operation
3.10 Stages of group formation: Forming, norming, storming and performing

Unit: 4 Gender and development 6 Hrs.

4.1 Meaning and concept of gender and sex, gender-based stereotypes
4.2 Origin of Gender and development in global and Nepalese context
4.3 Concept of WID, WAD and GAD, compare and contrast
4.4 Feminization of agriculture, role of women in agriculture and gender issues
4.5 Gender roles, Gender needs, gender strategy
4.6 Gender budget, gender audit and gender sensitive budget, Nepal's rules and Act
4.7 Concept of gender and social exclusion, domains, causes and strategy of mainstreaming
4.8 Nepal's policy, plan act and rules related to the gender mainstreaming

Practical

Unit 1:	Visit of rural community and identify social research issues through problem tree analysis tool	4 Hrs.
Unit 2:	Develop the skills to assess and identify famer's needs and priority	4 Hrs.
Unit 3:	Visit to a village to list out the taboos, folkways, rituals and social values in society	4 Hrs.

Unit 4:	Study on sampling method and techniques used in social survey	2 Hrs.
Unit 5:	Develop the knowledge and skills of data collection techniques	2 Hrs.
Unit 6:	Develop questionnaire for data collection	2 Hrs.
Unit 7:	Develop the knowledge and skill for information gathering from PRA, RRA: discussion, matrix, analysis, mapping	4 Hrs.
Unit 8:	Develop the skill of descriptive data analysis: table, graph, chart, diagram	4 Hrs.
Unit 9:	Develop the knowledge and skills in report writing and presentation	4 Hrs.

References:

1. Jaishi, M., & Paudel, I. (2020). *Social mobilization and community development: Textbook for undergraduate students*. Heritage Publisher Bhoitahity Kathmandu & RDTEC, Lamjung Campus.
2. Dongol, B. B. S. (2004). *Extension education*. Pratima Singh Dongol, Kathmandu, Nepal.
3. Khan, S.S., & Shah, J.S. (2001). *Social mobilization manual based on Syanja experience*, Social Mobilization Experimentation and Learning Center, UNDP/IAAS.
4. Mathialagan, P. (2007). *A textbook of animal husbandry & livestock extension*. International Book Distributing Co., Lucknow, India.
5. Nakkiran, S., & Ramesh, G. (2010). *Research method in rural development*. Deep and Deep Publication Pvt. Ltd., New Delhi, India.
6. Sandhu, A. A. (1993). *A textbook of communication process and method*. Raju Primlani for Oxford & IBH Publishing Company Pvt. Ltd., New Delhi, India.
7. Shankar Roa, C. N. (2011). *Sociology: Principle of sociology with an introduction to social thought*. S. Chand & Company Ltd., New Delhi, India.

Final written exam marking scheme

Unit	1	2	3	4	Total
Unit Hours	15	12	12	6	45
Marks	30	20	20	10	80

Entrepreneurship Development
EG 3201 MG

Year: III **Total: 5 Hrs. /week**
Semester: II **Lecture: 3 Hrs./week**
Tutorial: Hr./week
Practical: 2 Hrs./week
Lab: Hrs./week

Course Description:
This course is designed to provide the knowledge and skills on formulating business plan and managing small business. The entire course deals with assessing, acquiring, and developing entrepreneurial attitude; skills and tools that are necessary to start and run a small enterprise.

Course Objectives:
After completion of this course students will be able to:
1. Understand the concept of business and entrepreneurship;
2. Explore entrepreneurial competencies;
3. Analyze business ideas and viability;
4. Learn to formulate business plan with its integral components and
5. Manage small business.

Course Contents:

Theory

Unit 1: Introduction to Business & Entrepreneurship: [9 Hrs.]
- 1.1 Overview of entrepreneur and entrepreneurship
- 1.2 Wage employment, self- employment and business
- 1.3 Synopsis of types and forms of enterprises
- 1.4 Attitudes, characteristics & skills required to be an entrepreneur
- 1.5 Myths about entrepreneurs
- 1.6 Overview of MSMEs (Micro, Small and Medium Enterprises) in Nepal

Unit 2: Exploring and Developing Entrepreneurial Competencies: [9 Hrs.]
- 2.1 Assessing individual entrepreneurial inclination
- 2.2 Assessment of decision-making attitudes
- 2.3 Risk taking behavior and risk minimization
- 2.4 Creativity and innovation in business
- 2.5 Enterprise management competencies

Unit 3: Business identification and Selection: [4 Hrs.]
- 3.1 Sources and method of finding business idea(s)
- 3.2 Selection of viable business ideas
- 3.3 Legal provisions for MSMEs in Nepal

Unit 4: Business plan Formulation: **[18 Hrs.]**

4.1 Needs and importance of business plan

4.2 Marketing plan

- Description of product or service
- Targeted market and customers
- Location of business establishment
- Estimation of market demand
- Competitors analysis
- Estimation of market share
- Measures for business promotion

4.3 Business operation plan

- Process of product or service creation
- Required fix assets
- Level of capacity utilization
- Depreciation & amortization
- Estimation office overhead and utilities

4.4 Organizational and human resource plan

- Legal status of business
- Management structure
- Required human resource and cost
- Roles and responsibility of staff

4.5 Financial plan

- Working capital estimation
- Pre-operating expenses
- Source of investment and financial costs
- Per unit cost of service or product
- Unit price and profit/loss estimation of first year

4.6 Business plan appraisal

- Return on investment
- Breakeven analysis
- Risk factors

Unit 5: Small Business Management: **[5 Hrs.]**

5.1 Concept of small business management

5.2 Market and marketing mix

5.3 Basic account keeping

Practical

Unit 1: Overview of Business & Entrepreneurship [2 Hrs.]

1. Collect business information through interaction with successful entrepreneur

Unit 2: Exploring and Developing Entrepreneurial Competencies [2 Hrs.]

- Generate innovative business ideas

Unit 3: Product or service Identification and Selection [2 Hrs.]

1. Analyze business ideas using SWOT method

Unit 4: Business Plan Formulation [22 Hrs.]

1. Prepare marketing plan
2. Prepare operation plan
3. Prepare organizational and human resource plan
4. Prepare financial plan
5. Appraise business plan
6. Prepare action plan for business startup

Unit 5: Small Business Management [2 Hrs.]

1. Prepare receipt and payment account
2. Perform costing and pricing of product and service

Internship Program

(AG3204AS**)**

Year: III **Total: 390 hours**

Semester: II **Lecture: hours/week**

Tutorial: hour/week

Practical: 390 hours/week

Lab: hours/week

Description

In the second semester of the third/final year of their Diploma, students will be placed in different organizations (government organizations – research / extension or private organizations) under supervision to have practical experience of the job market. The duration of the internship is 3 months (390 hours). Internship will start only after the completion of all the subjects in the curriculum. It should end at least two weeks before the final exam conducted by CTEVT. The training institute is responsible for making arrangements for the internship. It should inform the CTEVT with details about the name of the student, internship site, plan and schedule.

Complete plan

SN	Activities	Duration	Remarks
1	Orientation	2 days	Before placement
2	Report to the site	1 days	Before placement
3	Actual work at the internship site	90 days (390 hours)	During internship period
4	Mid-term evaluation	one week	After 6 to 7 weeks of internship start date
5	Report to the parental organization	1 days	After placement
6	Final report preparation	5 days	After placement
7	Seminar/ evaluation from CTEVT or its nominee (external)	3 days	After 10 days of completion of internship

Mid-term evaluation is done after 6 weeks of placement and can be done by the institute itself or jointly with CTEVT. The students will be given one week after 3 months of internship to review and prepare the final report. The institute will fix the seminar date for the report in consultation with CTEVT. Final evaluation will be done as given below.

S. N	Evaluator	Marks
1	Supervisor of the organization in which the student is placed for the internship	100
2	The Training Institute	100
3	CTEVT or its nominee (external)*	100
	Total	**300**

Objective

- To make the students familiar with the job/ working areas related to their field of study
- To provide them opportunity to practice the skills they have gained during the academic period.
- To provide them with opportunity to learn about skills those are new or not covered in the institute.
- To explore the opportunities in the job market and plan their career accordingly.

Government Organization in the Agriculture Sector

Federal

- *Ministry of Agriculture and Livestock Development*
- *Department of Livestock Services*
- *Department of Food Technology and Quality Control*
- *Nepal Agriculture Research Council*
- *Seed Quality Control Centre*
- *Agriculture Information and Training Centre*
- *Plant Quarantine and Pesticide Management Centre*
- *Department of Agriculture*
  - Centre for Agricultural Infrastructure Development and Mechanization Promotion
  - National Centre for Potato, Vegetable and Spice Crops Development
  - National Centre for Fruit Development
  - Centre for Crop Development and Agro Bio-diversity Conservation –
    - Agriculture Farm Chandra Dangi and
    - Kanchanpur
  - Centre for Industrial Entomology Development
  - Central Agricultural Laboratory
- *Prime Minister Agricultural Modernization Project – Super zone, Zone, Block and Pockets*

Provincial Level

- *Ministry of Land Management, Agriculture and Cooperatives*
- *Agriculture Development Directorate*
  - Agriculture Business Promotion Support and Training Centre
  - Agriculture Knowledge Centers
  - District Agriculture Development Offices (In Some provinces e.g.; Karnali)
  - Livestock Service Expert Centre and Veterinary Hospital
  - Agricultural Farm Centers
  - Agricultural Laboratories-
    - Soil Laboratories
    - Seed Laboratories
    - Plant Protection Laboratories

Local Level

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

Expert involved in Curriculum Revision

Diploma in Animal Science

S.no	Expert Name	Designation	Organization
1.	Prof. Bhargab Dhital	Dean	Institute of Agriculture and Animal Science
2.	Prof. Dr. Manaraj Kolachhepati	Professor	IAAS, TU
3.	Pradip Poudel	Principal	Tanahun Technical School, Bhimad
4.	Ramesh Humagain	Senior Agriculture Development Officer	Ministry of Agricultural Development, Hariharbhawan
5.	Dr. Namrata Singh	Chief Livestock Development Officer	Livestock Department, Hariharbhawan
6.	Suraj Karki	Math Instructor	Nepal Banepa Polytechnic Institute, Banepa
7.	Dr. Huma Neupane	Lecturer	Paklihawa Campus, Paklihawa, Rupandehi
8.	Dr. Shambhu Shah	Lecturer	Paklihawa Campus, Paklihawa, Rupandehi
9.	Dr. Tanka Prasai	Chief Veterinary Officer	Central Referral Veterinary Hospital
10.	Prof. Dr. Bimal Karna	Campus Chief	IAAS, Surkhet
11.	Ram Bhajan Mandal	Campus Chief	Paklihawa Campus, Paklihawa, Rupandehi
12.	Dr Yam B Gurung	Reader	Paklihawa Campus, Paklihawa, Rupandehi
13.	Dr Madhav Acharya	Coordinator	NARC, Khumaltar
14.	Dr. Chuda Dhakal	Reader	IAAS, Kirtipur
15.	Prabin Shrestha	Computer Instructor	Nepal Banepa Polytechnic Institute, Banepa
16.	Dr. Dojaraj khanal	Chief, Animal Health Research Division	NARC, Khumaltar
17.	Dr. Rabindra Marahatta	Dept. Head, Animal Science	Jiri Technical School, Jiri
18.	Dr. Bodhnath Adhikari	Subject Specialist	-
19.	Dr. Loknath Poudel	Joint Secretary	Livestock Department, Hariharbhawan
20.	Shiromani Gajurel	Lecturer	KAFCOL, Balkumari
21.	Dr. Subir Singh	Reader	Agriculture and Forestry University, Chitwan
22.	Rajendra Gopal Shrestha	Dairy Technology Expert	-
23.	Leena Shah	Asst. Professor	KAFCOL, Balkumari

S.no	Expert Name	Designation	Organization
24.	Kaladhar Gaire	Senior Curriculum Officer	CTEVT
25.	Yadab Gaire	Lecturer	KAFCOL, Balkumari
26.	Nabin Darai	Lecturer	KAFCOL, Balkumari
27.	Ishwori Dutta Bhatta	Subject Expert	-
28.	Shalik Ram Dangi	Senior Agriculture Officer (Senior Trainer)	TITI
29.	Jay Krishna Poudel	Deputy director (Senior Agriculture Officer)	CTEVT
30.	Debesh Devkota	Director (Agriculture expert)	CTEVT
31.	Dr Pushpa Poudel	Lecturer	Paklihawa Campus, Paklihawa, Rupandehi
32.	Shanta Pokhrel	Instructor (Agriculture expert)	Shree Ishaneswor Secondary School, Lamjung
33.	Sudeep Devkota	Agriculture Development Officer	MOA
34.	Dr Kishor Chandra Dahal	Assistant Dean	IAAS TU