CURRICULUM
for
Diploma in Agriculture (Plant Science)
(Three Year -Yearly System Program)

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

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

Council for Technical Education and Vocational Education (CTEVT)

Sanothimi, Bhaktapur, Nepal

Contents

Introduction

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

Council for Technical Education and Vocational Training (CTEVT) has been able to produce skilled human resource in agriculture in Nepal. As the apex organization for technical and vocational human resource development, CTEVT 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).

Curriculum Title

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

Program Aim

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

Program Objectives

The curriculum has the following objectives:

- Provide agronomy, horticulture, and plant protection services for small-scale and commercial farming.
- Deliver extension and community development services as front-line extension workers.
- Conduct training for farmers as local resource persons to enhance land productivity, plant protection, soil management, fertilizer use, and adoption of new technology.
- Manage agribusiness and cooperative services in rural and urban areas across public and private sectors.
- Promote diverse agricultural practices including plant breeding, commercial vegetable production, mushroom cultivation, fruit crop production, medicinal plant production, and aquaculture.

- Promote organic and off-season vegetable production technologies and sustainable farming systems.
- Communicate effectively and collaborate in multidisciplinary, multicultural environments, with an understanding of global, environmental, social, and ethical contexts.
- Develop business plans to establish small scale ago-enterprises focused on production and services.
- Promote environmentally sustainable technologies, waste management practices, and green skills in agriculture to minimize ecological footprints and enhance eco-friendly farming systems.
- Apply climate-smart agricultural approaches, including drought-tolerant crop varieties, water conservation techniques, and adaptive farm management to ensure food security and farm sustainability in changing climate conditions.

Program Description

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

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

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Rationale for Revision

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

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

- Emerging and green technologies in agriculture must be incorporated to ensure relevance and sustainability.

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

Program Duration

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

Target Location

The target location is all over Nepal

Group Size

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

Target Group

The program is designed for eligible candidates interested in pursuing a career in agriculture, particularly those meeting CTEVT's admission requirements.

Entry Qualifications

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

  Or

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

Medium of Instruction

The medium of instruction is English and/or Nepali.

Pattern of Attendance

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

Instructor-Learners Ratio

The instructor-to-learners ratio is as follows:

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

Qualifications of Instructional Staff

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

Instructional Media and Materials

The program utilizes the following instructional media and materials:

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

Teaching Learning Methodologies

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

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

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

Examinations and Marking Scheme

a. Internal Assessment

- A transparent and fair evaluation system for both theory and practical components of each subject.
- Internal assessments are conducted at regular intervals, with feedback provided to learners.
- Weightage of theory and practical marks are specified in curriculum structure.
- Continuous assessment formats will be developed and applied by the evaluators for evaluating learner's performance in the subjects related to the practical task.
- Continuous Assessment Marks (CAM) are specified for the practical component of each disciplinary subject, based on its List of Tasks.

b. Final Examination

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

Completion of internal assessment requirements is mandatory to be eligible for the final examination.

c. Requirement for Final Practical Examination

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

d. Final Practical Assessment Criteria:

- Institutional practical attendance: 10%
- Logbook or practical record updates: 10%
- Spot performance (assigned task/practicum performance/identification/arrangement preparation/measurement): 50%
- Viva voce:
    - Internal examiner: 15%
    - External examiner: 15%
- Based on above mentioned criteria institute must developed format and assess accordingly.

e. Pass Marks:

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

Provision for Re-examination

- A provision for re-examination exists for the learners who fail a subject.
- Learners must pass all subjects across all years within six years from their enrollment date.

- Final-year learners are eligible for supplementary examinations as per CTEVT guidelines.

Grading System

The grading system is as follows:

	Grading	**Overall marks**
•	Distinction:	80% and above
•	First division:	65% to below 80%
•	Second division:	50 % to below 65%
•	Pass division:	40 % to below 50%

Certificate Awarded

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

Questions Pattern

Full Marks 80

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

Two questions are based on List of Tasks in the disciplinary subject**.**

Full Marks 40

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

One question is based on List of Tasks in the disciplinary subject.

Career Path

- Graduates are eligible for positions equivalent to Non- gazetted First class/Level 5 (Technical) in the agriculture sector as recognized by the Public Service Commission of Nepal.
- Start and manage their own agri-enterprises in areas like vegetable farming, seed production, nursery management, organic farming, agro-processing and other related areas.
- Employed as production supervisors or farm managers in commercial farms, agribusiness companies, nurseries, or agro-vet firms.

- Work with NGOs/INGOs working on the rural development, food security and sustainable agriculture.
- Pursue further studies in Bachelor-level programs such as B.Sc. Agriculture or related disciplines.

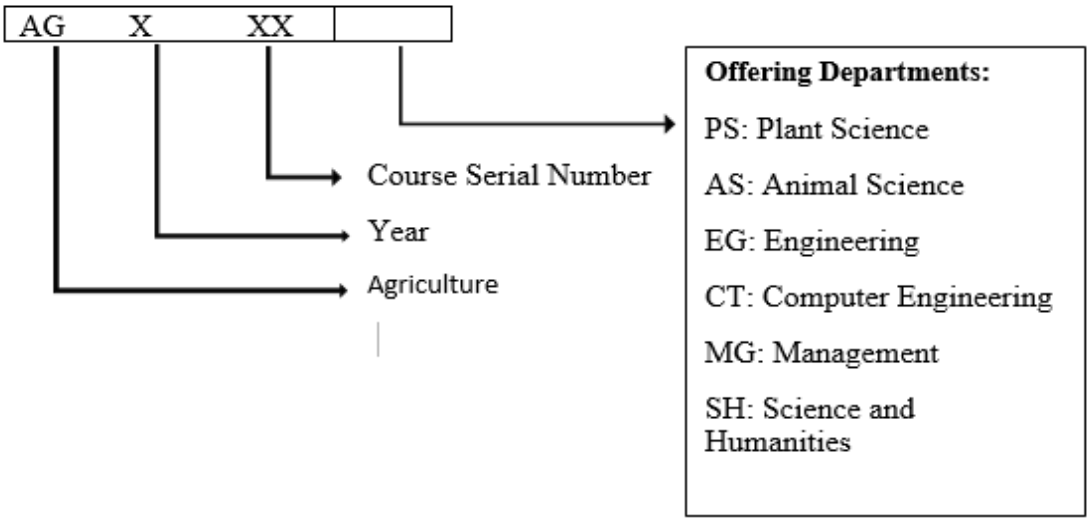
General Attitudes Required

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

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

Subjects Codes

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



Course Structure:

Diploma in Agriculture (Plant Science)

First Year

Subjects			Mode		Hours		Marks distribution						Total Marks	Remark
							Theory			Practical				
S.N.	Code	Title	Theory	Practical	Weekly	Credit	*Assmt Marks	Final Marks	Time Hrs.	*Assmt Marks	Final Marks	Time Hrs.		
1	AG-101-PS	Basic Agricultural Science	2	3	5	4	10	40	1.5	60	40	4	150	*Continuous assessment
2	AG-102-PS	Commercial Agriculture	2	3	5	4	10	40	1.5	60	40	4	150	
3	AG-103-SH	Mathematics	4	1	5	5	20	80	3	25	-	-	125	
4	AG-104-SH	Physics	4	2	6	5	20	80	3	30	20	3	150	
5	AG-105-SH	Chemistry	4	2	6	5	20	80	3	30	20	3	150	
6	AG-106-SH	Zoology	3	2	5	4	20	80	3	30	20	3	150	
7	AG-107-SH	Botany	3	2	5	4	20	80	3	30	20	3	150	
8	AG-108-PS	Basic Animal Husbandry	2	1	3	3	10	40	1.5	25	-	-	75	
		Total	**24**	**16**	**40**	**34**	**130**	**520**		**290**	**160**		**1100**	

Second Year

Subjects			Mode		Hours		Marks distribution						Total Marks	Remark
							Theory			Practical				
S.N.	Code	Title	Theory	Practical	Weekly	Credit	*Assmt Marks	Final Marks	Time Hrs.	*Assmt Marks	Final Marks	Time Hrs.		
1	AG-201-SH	English	3	1	4	4	20	80	3	25	-	-	125	*Continuous assessment
2	AG-202-PS	Soil Fertility Management	3	2	5	4	20	80	3	30	20	3	150	
3	AG-203-PS	Horticultural Crop Production	3	4	7	5	20	80	3	60	40	4	200	
4	AG-204-PS	Agronomical Crop Production	3	2	5	4	20	80	3	30	20	3	150	
5	AG-205-PS	Plant Protection	4	2	6	5	20	80	3	30	20	3	150	
6	AG-206-PS	Extension and Communication	2	1	3	3	10	40	1.5	25	-	-	75	
7	AG-207-PS	Seed Technology	2	2	4	3	10	40	1.5	30	20	3	100	
8	AG-208-PS	Agricultural Project	-	6	6	3	-	-	-	90	60		150	
		Total	**20**	**20**	**40**	**31**	**120**	**480**		**320**	**180**		**1100**	

Third Year

Subject			Mode		Hours		Marks distribution						Total Marks	Remark
S.N.	Course Code	Course Title	Theory	Practical	Weekly	Credit	Theory			Practical				
							*Assmt Marks	Final Marks	Time Hours	*Assmt Marks	Final Marks	Time Hours		
1	AG-301-SH	Nepali	3	-	3	3	20	80	3	-	-	-	100	*Continuous assessment
2	AG-302-PS	Post-Harvest Technology	2	1	3	3	10	40	1.5	25	-	-	75	
3	AG-303-PS	Agricultural Economics, Marketing and Cooperatives	2	2	4	3	10	40	1.5	30	20	3	100	
4	AG-304-PS	High Value and Exportable Crop Enterprise	2	1	3	3	10	40	1.5	25	-	-	75	
5	AG-305-PS	Urban and Organic Agriculture	2	2	4	3	10	40	1.5	30	20	3	100	
6	AG-306-MG	Entrepreneurship Development	1	2	3	2	25	-	-	30	20	3	75	
		Total	**12**	**8**	**20**	**17**	**85**	**240**		**140**	**60**		**525**	

7	AG-307-PS	Internship	**Weekly Hours**	5	**Practical Final Marks**			OCE= Office of controller of Examination
					Industry/Supervisor	**Internal/Institute**	**External/OCE**	**Total**
			20		200	200	100	500
Total								**1025**

First year

1 Basic Agricultural Science
2 Commercial Agriculture
3 Mathematics
4 Physics
5 Chemistry
6 Zoology
7 Botany
8 Basic Animal Husbandry

Basic Agricultural Science
Course Code: AG-101-PS

Year: I

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

Course Description

This course aims to provide fundamental knowledge and skills in agricultural science. It covers the core concepts of agricultural disciplines and equips learning in real-world agricultural settings.

Course Objectives

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

- Explain the scope and importance of Agriculture.
- Describe different farming systems.
- Enumerate key terminology related to basic agriculture.
- Explain basic concepts of horticulture, agronomy, plant protection, and soil science.
- Perform basic horticultural, agronomical, plant protection, and soil management practices.
- Explain under-utilized, organic, and sustainable agriculture.
- Apply concepts of permaculture, biodynamic agriculture, and agroforestry.

Course Contents

Theory **70 Hrs.**

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

1.1 Concept, scope, and branches of Agriculture
1.2 Definition and Differentiation of subsistence and commercial agriculture

Unit 2 : Introduction to Agronomy **12 Hrs.**

2.1 Concept and classification of agronomy
2.2 Definition of cropping system & cropping pattern
2.3 Types of cropping system (Definitions and examples)
  2.3.1 Monoculture and Mixed culture
  2.3.2 Relay cropping and intercropping
  2.3.3 Cover cropping and catch cropping
  2.3.4 Cropping scheme and crop rotation
  2.3.5 Cropping intensity and cropping index
2.4 Definition of tillage, irrigation, drainage and weeds
2.5 Definition of seed, grain and seed priming
2.6 Methods of seed sowing and their implications.
2.7 Definition of plant breeding, hybrid seed and improved seed production

Unit 3 : Introduction to Horticulture **15 Hrs.**

3.1 Concept and classification of horticulture

3.2 Definitions of floriculture, olericulture, pomology, and post-harvest management
3.3 Concept and importance of off-season and protected vegetable cultivation
3.4 Concept and importance of urban and peri-urban vegetable farming
3.5 List of tropical, sub-tropical, and temperate fruit crops in Nepal
3.6 Definition of nursery, seedling, sapling, cutting, and grafting
3.7 Methods of plant propagation and their implications.
3.8 Differentiation of training and pruning
3.9 Definition of different intercultural practices: weeding, mulching, shading, nipping, staking, harvesting, and storing
3.10 Definition, uses, and examples of windbreak and alley cropping
3.11 Definition, benefits and examples of sod culture and contour cropping
3.12 Definition, uses, and examples of Plant growth regulators (PGRs)
3.13 Concept of photoperiodism, germination, dormancy, Juvenile phase and pollination
3.14 Concept of Hydroponics and aeroponics

Unit 4 : Introduction to Soil 11 Hrs.

4.1 Concept and classification of soil
4.2 Physical, chemical, and biological properties of soil
4.3 Concept of organic and chemical fertilizers
4.4 Definition, examples, and use of green manuring, mulching and cover crops
4.5 Soil sampling: Concept, importance, and techniques

Unit 5 : Introduction to Agricultural Entomology 8 Hrs.

5.1 Concept of agricultural entomology, pests, insects, rodents, nematodes and insecticides
5.2 General characteristics and specialties of insects
5.3 Types and behaviors of harmful and beneficial insects with examples
5.4 Insect morphology: body regions, mouth parts, antennae, photoreceptors, legs and wings.

Unit 6 : Introduction to Plant Pathology 6 Hrs.

6.1 Concepts of plant pathology, micro-organisms, pathogens, fungi, bacteria, viruses, diseases, symptoms, signs and syndromes
6.2 Definition and examples of insecticides, fungicides, nematicides, antibiotics, rodenticides, herbicides.

Unit 7 Weather and Climate 5 Hrs.

7.1 Differentiate between weather and climate
7.2 Climatic factors affecting crop production: temperature, light, rainfall, humidity, relative humidity, wind, snow, hailstorms and soil moisture

Unit 8 : Underutilized and Neglected Crop, and Sustainable farming 10 Hrs.

8.1 Introduction to Underutilized and Neglected Crops
8.2 Importance and potential of underutilized crops in Nepal
8.3 Concept and importance of Sustainable Agriculture
8.4 Overview of permaculture and biodynamic farming
8.5 Concept and benefits of Agroforestry

Practical: **105 Hrs.**

S.N.	List of Tasks	Hrs.	CAM
1	Identify field crops, fruits, vegetables, ornamental plants, and their seeds	12	10
2	Identify and label tools and equipment used in agricultural field	6	6
3	Prepare a report on the use of different equipment/tools in agricultural practices	4	4
4	Prepare different types of nursery beds.	6	6
5	Perform pruning and training practices on fruit and ornamental plants.	6	6
6	Identify chemical and organic fertilizers available in local market.	4	4
7	Identify major crops pests.	6	6
8	Identify major crops diseases.	6	6
9	Perform land preparation and seed sowing for crops.	6	6
10	Transplant vegetable seedlings.	6	6
11	Perform cutting, grafting and layering on plants.	6	6
12	Prepare soil samples from fruit orchard for testing.	4	4
13	13.1Visit a nearby agricultural farm to observe production processes. 13.2 Prepare a report in MS Word and present in group using MS PowerPoint.	12	11
14	Observe different irrigation practices.	4	4
15	Lay-out an orchard.	5	5
16	Perform green manuring for field crops suited to local conditions.	12	10
Total		**105**	**100**

Learning References:

- Baliyan, J. S. (2014). *Elementary agriculture*. Rastogi Publications
- Foth, H. D. (1990). *Fundamentals of soil science* (8th ed.). John Wiley & Sons.
- Kaini, B. R. (2020). *Understanding Nepalese agriculture*. Heritage Publishers & Distributors Pvt. Ltd.

- Reddy, T. Y., & Reddi, G. H. S. (2016). *Principles of agronomy* (5th ed.). Kalyani Publishers.
- Saud, N. B. (2010). *Nepalka Balinali ra tinko digo kheti* [Crops of Nepal and their sustainable farming]. Sajha Prakashan.
- Singh, J. (2011). *Fundamentals of horticulture* (4th ed.). Kalyani Publishers.
- Vyas, A. K. (2012). *Introduction to agriculture*. Agrotech Publishing Academy.

Final written exam marking scheme

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

(Pr. = Practical)

Commercial Agriculture
Course Code: AG-102-PS

Year: I

Total: 4 hours /week
Theory: 2 hours/week
Practical: 3 hours/week

Course description
This course provides knowledge and skills on commercial agricultural practices, emphasizing globalization, trade and current government policies and support programs in Nepal. It equips with essential competencies to engage in commercial agriculture and apply them in real world of work settings.

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

- Explain the concept, principles, resources base, current trends, needs and prospects of commercial agriculture.
- Apply farm machinery for commercial agriculture practice.
- Analyze agricultural trade in the context of government policies and support programs.
- Explain value chains, market linkages and marketing channel of agriculture in Nepal.
- Apply concepts of precision agriculture and its applications.

Course Contents
Theory **70 Hrs.**

Unit 1 : Introduction to Commercial Agriculture **8 Hrs.**

1.1 Concept, definition, and characteristics of commercial agriculture
1.2 Differences between commercial and subsistence agriculture
1.3 Principles and techniques of commercial agriculture
1.4 Needs and prospects of commercial agriculture in Nepal
1.5 Current trends of commercial agriculture
1.6 Status of commercial agriculture in Nepal
1.7 Challenges and opportunities for commercial agriculture in Nepal

Unit 2 : **Agriculture Trade** **5 Hrs.**

2.1 Current trends in agricultural trade under globalization
2.2 Legal provisions regulating agricultural trade in Nepal
2.3 Trade issues and World Trade Organization (WTO) obligations for agriculture in Nepal

Unit 3 : Farm Mechanization **12 Hrs.**

3.1 Availability and limitations of farm power sources in Nepal
3.2 Nepalese indigenous agricultural tools: introduction, structural details, functions and comparison with modern machinery

3.3 Introduction to tractors and their types
3.4 Types of seeding and planting machines, including furrow openers for major crops
3.5 Definition, components and types of rice and wheat threshing machines and combines harvester
3.6 Aquifers and types of pumps: reciprocating, centrifugal, turbine and propeller pumps

Unit 4 : **Mushroom Cultivation** **10 Hrs.**

4.1 Scope and Importance of mushroom cultivation
4.2 Problems and constraints of mushroom cultivation
4.3 Types of cultivated and wild edible mushrooms
4.4 Mushroom Spawn: Introduction and production process
4.5 Cultivation practices of Oyster/*Pleurotus spp*, Button/*Agaricus bisporus* and shiitake/ *Lentinula edodes* mushroom
4.6 Insects pests and diseases management of mushroom
4.7 Mushroom poisoning

Unit 5 : Digital Agriculture **5 Hrs.**

5.1 Concepts, definition and features of digital agriculture
5.2 Digital platforms for commercial agriculture in Nepal
5.3 Digital agriculture initiatives in Nepal
5.4 Opportunities and challenges of digital agriculture in Nepal

Unit 6 : Government Policies and Support Programs **10 Hrs.**

6.1 National Agriculture Policy 2061 and its updates
6.2 Crop insurance in Nepal: Concepts, history and provisions
6.3 Support and subsidies provisions of different level of government

Unit 7 : Value Chain and Market Linkages **5 Hrs.**

7.1 Terminology, history, concept and definitions of value chains
7.2 Agricultural value chain approaches
7.3 Status of agricultural value chain in Nepal
7.4 Funding mechanisms for value chain development
7.5 Marketing channels for agricultural products in Nepal

Unit 8 : Good Agricultural Practices (GAP) **5 Hrs.**

8.1 Concepts, definition and historical development of GAP
8.2 Relevance, barriers and institutionalization of GAP in Nepal

Unit 9 : High-Density Farming **4 Hrs**.

9.1 Concepts and definition of high-density farming
9.2 Advantages and disadvantages of high-density farming
9.3 Techniques used in high density farming
9.4 Status of high-density farming in Nepal

Unit 10 : Precision Agriculture **6 Hrs.**

10.1 Concepts and definition of precision agriculture

10.2 Importance and scope of precision agriculture
10.3 Tools and equipment used in precision agriculture
10.4 Steps in implementing precision agriculture
10.5 Types of protected structure

Practical: **105 Hrs.**

S.N.	List of Tasks	Hrs.	CAM.
1	Assess indigenous agricultural tools, instruments and machines, collect samples and compare with modern tools used in commercial agriculture.	6	6
2	Visit a local commercial vegetable/fruit farm, flower nursery or landscape; study techniques and principles and prepare a report in MS Word.	6	6
3	Design and construct a 6m x 10m plastic house layout for off-season vegetable production.	6	6
4	Practice mulching of fruit trees and vegetable transplanting beds using grasses, dry leaves and plastic.	6	6
5	Prepare compost using locally available materials with use of effective microorganism (EM).	6	6
6	Operate different types of sprayers for pest and disease control.	8	8
7	Operate farm machinery (power tillers) and perform repair and maintenance tasks.	30	25
8	Prepare seeding/planting beds of seasonal flowers.	4	4
9	Prepare nursery beds or media for poly pots/seed trays and raise vegetable seedlings.	6	6
10	Prepare fields for sowing/transplanting seasonal vegetables. .	6	6
11	Prepare hotbeds for winter season nursery. .	5	5
12	Practice irrigation methods for vegetables and fruit crops (surface, sub-surface, sprinkler and drip irrigation).	8	8
13	Prepare a cropping calendar for open fields and protected structures across three ecological zones.	4	4
14	Develop farm record keeping systems for commercial farms.	4	4
Total		**105**	**100**

Final written exam marking scheme

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

Learning References

- Kaini, M. (2019). Agro-tourism in Nepal: a rural development perspective. *Nepalese journal of development and rural studies*, *16*, 53-65.
- Kharel, M., Dahal, B. M., & Raut, N. (2022). Good agriculture practices for safe food and sustainable agriculture in Nepal: A review. *Journal of Agriculture and Food Research*, *10*, 100447.

Mathematics

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

Year: I **Total: 5 hours /week**
Theory: 4 hours/week
Practical: 1 hour/week

Course description

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

Course objectives

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

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

Course content

Theory **140 Hrs.**

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

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

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

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

Unit 3 : Trigonometry **8 Hrs.**

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

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

4.1 Quadratic equations and the nature of their roots.

4.2 Relationship between roots and coefficients.

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

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

5.1 Straight lines 10 Hrs.

5.1.1 Three standard forms of equations of straight lines

5.1.2 Angles between two lines

5.1.3 Parallel and perpendicular lines

5.1.4 Point of intersection of lines

5.2 Pairs of lines 8 Hrs.

5.2.1 Homogeneous equations of second degree

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

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

5.3 Circles 4 Hrs.

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

5.3.2 General equation of circle

Unit 6 : Calculus **20 Hrs.**

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

6.2 Derivatives 6 Hrs.

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

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

6.3 Application of derivatives 6 Hrs.

6.3.1 Increasing and decreasing functions

6.3.2 Local maxima and minima

6.4 Antiderivatives 4 Hrs.

6.4.1 Indefinite integral: general integral (algebraic integral only)

6.4.2 Substitution method (algebraic function only)

Unit 7 : Statistics **34 Hrs.**

7.1 Introduction to statistics 8 Hrs.

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

7.2 Organization of data 6 Hrs.

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

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

7.3 Presentation of data 6 Hrs.

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

7.4 Measures of central tendency 7 Hrs.

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

7.5 Measures of Dispersion 7 Hrs.

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

Unit 8 : Probability 8 Hrs.

8.1 Concepts of probability

8.2 Addition and multiplication theorem (Related problems only)

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

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

Unit 9 : Vectors 6 Hrs.

9.1 Vectors and their types

9.2 Vectors in two and three dimensions

9.3 Unit vectors (i, j, k)

9.4 Collinear and coplanar vectors

Unit 10 : Matrices and determinants 8 Hrs.

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

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

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

Unit 11 : Mensuration 6 Hrs.

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

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

11.3 Perimeter and area of circle and semi-circle

Practical 35 Hrs.

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

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

Learning References

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

Final written exam marking scheme

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

Physics

Course Code: AG-104-SH

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

Course Description

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

Course objectives

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

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

Course Contents **140 Hrs.**

Unit 1 : Mechanics **30 Hrs.**

1.1 Units and Measurement **3 Hrs.**

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

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

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

1.3 : Kinematics **4 Hrs.**

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

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

1.4 : Force **6 Hrs.**

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

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

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

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

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

1.7 : Hydrostatics **3 Hrs.**

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

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

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

Unit 2 : Heat **22 Hrs.**

2.1 : Thermometry **3 Hrs.**

2.1.1 Concepts of heat and temperature

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

2.2 : Thermal Expansion **5 Hrs.**

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

2.3 : Calorimetry **4 Hrs.**

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

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

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

2.5 : Thermodynamics **5 Hrs.**

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

Unit 3 : Light **20 Hrs.**

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

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

3.2 : Refraction **6 Hrs.**

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

3.3 : Optical Instruments **4 Hrs.**

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

3.3.3 Basic concept on interference and diffraction

3.4 : Prism **4 Hrs.**

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

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

4.1 : Waves **5 Hrs.**

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

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

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

Unit 5 : Electrostatics **8 Hrs.**

5.1 : Fundamentals of Electrostatics

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

Unit 6 : Magnetism **15 Hrs.**

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

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

6.2 : Terrestrial Magnetism **5 Hrs.**

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

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

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

7.1 : Electric current **5 Hrs.**

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

7.2 : Electrical Measurement **2 Hrs.**

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

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

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

7.4 : Electromagnetism **4 Hrs.**

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

7.5 : Alternating Current **3 Hrs.**

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

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

8.1 : Electron **3 Hrs.**

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

8.2 : Photoelectricity **4 Hrs.**

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

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

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

8.4 : Radioactivity **5 Hrs.**

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

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

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

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

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

Practical **70 Hrs.**

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

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

Learning References

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

Final written exam marking scheme

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

Chemistry
Course Code: AG-105-SH

Year: I

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

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

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

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

Course Contents
Theory **140 Hrs.**

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

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

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

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

2.1 Introduction of sub-atomic particles (electron, proton, and neutron).

2.2 Description of Rutherford's nuclear model of the atom.
2.3 Description of Bohr's atomic model.
2.4 Description with examples of atomic number, mass number, atomic weight, and gram atomic weight.
2.5 Arrangement of electrons in orbits (Aufbau principle).

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

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

Unit 4 : Chemical bonding 4 Hrs.

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

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

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

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

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

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

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

Unit 8 : Oxidation and Reduction 7 Hrs.

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

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

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

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

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

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

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

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

Unit 1 : Water **5 Hrs.**

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

Unit 2 : Metals **7 Hrs.**

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

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

3.1 Hydrogen:

3.1.1 Physical and chemical properties (reaction with O_2, Na, Ca, X_2 and N_2)

3.1.2 Introduction of vegetable oil and heavy water,

3.1.3 Isotopes and uses of hydrogen.

3.2 Oxygen:

3.2.1 Physical and chemical properties (reaction with Ag, Na, H_2, SO_2, NH_3 and N_2)

3.2.2 Uses of oxygen.

3.3 Nitrogen:

3.3.1 Manufacture of ammonia by Haber's process (principle with a diagrammatic sketch).

3.3.2 Physical and chemical properties of ammonia (action with metals, basic nature),

3.3.3 Uses of ammonia in agriculture.

3.4 Carbon:

3.4.1 Description of allotropes of carbon (graphite and diamond)

3.4.2 Physical and chemical properties of carbon dioxide (reaction with Na, Mg, H_2O and lime water),

3.4.3 Uses of carbon dioxide.

3.5 Halogens: General characteristics of halogens.

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

4.1 Nitric acid: Manufacture of nitric acid by Ostwald process (principle with a diagrammatic sketch), physical and chemical properties (action with Zn, Cu, and salts).

4.2 Hydrochloric acid: physical properties, acidic nature, chemical properties (action with ammonia, silver nitrate, and salts), and uses.

4.3 Description of NPK fertilizer.

4.4 Differentiate between natural and artificial fertilizers.

4.5 Role of NPK fertilizer in the plant.

4.6 Listing advantages and disadvantages of chemical fertilizer.

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

Unit 5 : Environmental Chemistry **6 Hrs.**

5.1 Introduction and sources of air pollution and its effects on agriculture.

5.2 Introduction and effects of water pollution.

5.3 Description of soil pollution and solid waste management

5.4 Introduction, causes, adverse effects and control measures of the greenhouse effect, ozone layer depletion and acid rain.

Part II: Organic Chemistry **45 Hrs.**

Unit 1 : Introduction to Organic Compounds **10 Hrs.**

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

Unit 2 : Hydrocarbons **6 Hrs.**

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

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

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

Unit 4 : Alcohol **5 Hrs.**

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

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

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

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

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

Unit 7 : Ethers **4 Hrs.**

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

7.4 Uses in medicine and everyday life.

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

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

Unit 9 : Phenol **4 Hrs.**

9.1 Preparation of phenol from benzene diazonium chloride and sodium benzene sulphonate.
9.2 Physical and chemical properties (action with Na, Zn, NH3, benzene diazonium chloride,
9.3 Kolbe's reaction.

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

10.1 List of medicinal plants found in Nepal.
10.2 Description of phytochemical technique; extraction, isolation, purification and characterization of natural products.

Practical: **70 Hrs.**

S. N.	**Practical task**	**Hrs.**
1.	Develop procedural rules and guidelines for the chemistry laboratory.	2
2.	Establish lab safety protocols and first aid measures for chemistry labs.	4
3.	Document laboratory procedures and maintain laboratory records.	3
4.	Handle chemistry lab equipment.	4
5.	Cut and bend glass tubes at various angles and prepare a delivery tube for gas collection.	2
6.	Perform filtration to separate mixtures. (sand and salts)	2
7.	Conduct sublimation to purify substances. (sand and Camphor)	2
8.	Perform precipitation reactions and observe precipitate formation.	2
9.	Perform distillation to separate liquids.	3

10.	Conduct evaporation processes for sample concentration.	2
11.	Conduct crystallization processes for substance purification.	2
12.	Perform acid-base reactions and study their properties.	4
13.	Prepare and study the properties of gases (hydrogen, ammonia, and carbon dioxide) in the lab.	6
14.	Determine the equivalent weight of a metal using the hydrogen displacement method.	3
15.	Conduct acid-base titrations to determine solution strengths.	4
16.	Detect the acid radicals (Cl^-, NO_3^{--}, SO_4^{--}, CO_3^{--}) using dry and wet tests.	6
17.	Detect the basic radicals (Cu^{++}, Al^{+++}, Fe^{+++}, Zn^{++}) using wet tests.	4
18.	Prepare solutions of various strengths and concentrations.	4
19.	Detect the presence of nitrogen, sulphur, and halogens in organic compounds.	4
20.	Identify functional groups in organic compounds.	4
21.	Measure pH values of soil samples using PH meter.	3
Total		**70**

Learning References

- Jha, J. S., & Gugliani, S. K. *A textbook of chemistry* (Current ed.). Seirya Publication.
- Sthapit, M., & Pradhananga, R. R. *Fundamentals of chemistry* (Vols. I & II, Current ed.). Taleju Prakashan.
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- Bhattarai, D. P. *Modern agricultural chemistry*. Asmita Publication.

Final written exam marking scheme

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

Zoology
Course Code: AG-106-SH

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

Course Code: AG-106-SH

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

Course Objectives:
Upon completion of this course, learners will be able to:
- Identify common organisms by their local Nepali, common English, and scientific names.
- Define the meaning, scope, and branches of zoology.
- Describe the structure of cells and explain the functions of different body tissues.
- Classify various forms of animal life.
- Analyze the anatomical and physiological characteristics of mammals.

Course Contents

Theory **105 Hrs.**

Unit 1 : Introduction to Zoology **4 Hrs.**
1.1 Definition and Scope of Zoology
1.2 Branches of Zoology (Morphology, Anatomy, Physiology, Cytology, Histology, Embryology, Hematology, herpetology, Parasitology, Entomology, Helminthology, Proto-zoology, Bacteriology, Virology, Paleontology, Ecology, Genetics, Toxicology)
1.3 Relationship of zoology with other sciences (Physics, Chemistry and Statistics)
1.4 Preservation Techniques
1.4.1 Definition and importance of preservation
1.4.2 Wet and dry methods of preservation
1.4.3 Protocols for preserving zoological specimens

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

2.1 Introduction to Cells 4 Hrs.

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

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

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

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

2.2 Cell Division 7 Hrs.

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

2.2.2 Types of cell division: Amitosis, mitosis and meiosis

2.2.3 Significance of amitosis, mitosis and meiosis

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

2.2.5 Differences between mitosis and meiosis.

Unit 3 : Study of Microscope 3 Hrs.

3.1 Definition and importance of microscopes and its types

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

Unit 4 : Tissues and Their Types 6 Hrs.

4.1 Definition of tissues

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

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

Unit 5 : Diversity of Animal Life 6 Hrs.

5.1 Concept of Taxonomy 2 Hrs.

5.1.1 Definition of taxonomy, higher taxon, and lower taxa

5.1.2 Species as the basic unit of classification

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

5.1.4 Differences between artificial and natural classification

5.2 Binomial Nomenclature and Classification 4 Hrs.

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

5.2.2 Listing of the importance of nomenclature

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

5.2.4 Characteristics and listing of the five kingdoms classification.

Unit 6 : Animal Phylogeny and Classification 6 Hrs.

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

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

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

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

7.3 Theories of organic evolution

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

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

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

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

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

8.1 Systematic position, habit and habitat of earthworm

8.2 Morphology of earthworm with labeled sketches.

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

8.4 Digestive system and physiology of digestion in earthworm.

8.5 Male and female reproductive organs of earthworm.

8.6 Vermicomposting: definition, mechanism and benefits for agriculture

8.7 Economic importance of earthworms.

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

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

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

9.3 Silkworm rearing in Nepal: sericulture practices

9.4 Economic importance of honeybees and silkworms.

9.5 Characters of silk thread.

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

10.1 Systematic position of humans

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

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

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

Unit 11 : Ecosystem **8 Hrs.**

11.1 Introduction to ecosystem

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

11.2 Bio-geochemical cycles 4 Hrs.
11.2.1 Definition of biogeochemical cycle.
11.2.2 Description of carbon cycle, water cycle, oxygen cycle and nitrogen cycle

11.3 Environmental Pollution 4 Hrs.
11.3.1 Definition and types of pollution
11.3.2 Biodegradable and non-biodegradable pollutants with examples
11.3.3 Water, air and soil pollution: sources, effects and preventive measures
11.3.4 Introduction, importance and techniques of solid waste management

Unit 12 :Animal Adaptation 4 Hrs.
12.1 Introduction to animal adaptation
12.2 Definition of aquatic and terrestrial adaptation with examples
12.3 Description of adaptation features of aquatic and terrestrial adaptation with examples

Unit 13 :Animal Behavior 4 Hrs.
13.1 Definitions: reflex action, taxis, photo taxis, chemotaxis, geotaxis, thermotaxis, rheotaxis, galvanotaxis, thigmotaxis, leadership and qualities of a leader, behavior, learned behavior and innate behavior
13.2 Listing of some common examples of leadership in animals

Unit 14 : Conservation of Wildlife 8 Hrs.
14.1 Definition of wildlife
14.2 Methods and importance of wildlife conservation
14.3 Description of conservation strategies for wildlife
14.4 IUCN classifications: Extinct (EX), critically endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Threatened Species
14.5 Listing of the rare, threatened, and endangered species in Nepal
14.6 Role of IUCN and causes of wildlife extinction in Nepal
14.7 Explanation of the national parks and wildlife reserves of Nepal
14.8 Definition of afforestation and its importance
14.9 Role of forest conservation in wildlife protection
14.10 Causes and Consequences of deforestation

Practical: 70 Hrs.

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

Learning References

- Bam, A. K., Jha, B. S., Subedi, J. R., Shah, R. B., & Jha, D. B. *Zoology for agriculture with practical*. Advance Ayam Publication.
- Keshari, A. *A textbook of zoology for health sciences*. Vidyarthi Pustak Bhandar.
- Kotpal, R. L. *Modern textbook of zoology: Invertebrates*. Rastogi Publications.
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- Keshari, A. *Practical biology*. Vidyarthi Publication.
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- Labh, S. N. *A textbook of practical biology*. Taleju Prakashan.
- Keshari, A., Ghimire, K. R., & Mishra, B. S. *Practical biology for class XI*. Vidyarthi Pustak Bhandar.

Final written exam marking scheme

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

Botany

Subject Code: AG-107-SH

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

Course description:

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

Course objectives:

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

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

Course contents

Theory **105 Hrs.**

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

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

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

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

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

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

3.4 Internal Structure of dicot and monocot leaves and stems

Unit 4 : Plant Physiology **12 Hrs.**

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

Unit 5 : Taxonomy and Biodiversity **40 Hrs.**

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

Unit 6 : Embryology of Angiosperm **8 Hrs.**

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

Unit 7 : Genetics **6 Hrs.**

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

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

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

Unit 9 : Biotechnology **8 Hrs.**

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

Practical: **40 Hrs.**

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

Learning References

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

Final written exam marking scheme

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

Basic Animal Husbandry
Course Code: AG-108-PS

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

Course Description
This course provides essential knowledge and skills in animal husbandry, including care, nutrition, breeding, housing, and poultry production. It covers domestic animal classification in Nepal and promotes sustainable livestock practices for employment in both private and public sectors.

Course Objectives:
Upon completion of this course, learners will be able to:
- Explain the basics of livestock production systems and their role in Nepal
- Demonstrate techniques for improved livestock management practices
- Develop ideas of self-employment through animal rearing
- Provide technical services to private and government farms

Course Contents
Theory **70 Hrs.**

Unit 1 : Introduction to Animal Husbandry **4 Hrs.**
1.1 Zoological classification of common domestic animals
1.2 Importance and scope of livestock production in Nepal
1.3 Status of livestock population, distribution, and its contribution to GDP in Nepal
1.4 Livestock as a component of mixed farming system

Unit 2 : Physiology of Animals **4 Hrs.**
2.1 Digestive organs of ruminants: general anatomy, parts, and their functions
2.2 Digestive organs of non-ruminants: general anatomy, parts, and their functions

Unit 3 : Mechanisms of Animal Reproduction **4 Hrs.**
3.1 Male reproductive organs: general anatomy, parts, and their functions
3.2 Female reproductive organs: general anatomy, parts, and their functions
3.3 Sexual cycle and heat detection methods

Unit 4 : Animal Breeding and Artificial Insemination **6 Hrs.**
4.1 Economic and physiological traits of selection
4.2 Systems of breeding: types (inbreeding, outbreeding, crossbreeding), merits, demerits, and application
4.3 Artificial insemination (AI): introduction, advantages and disadvantages
4.4 Semen collection, examination and evaluation
4.5 Artificial insemination techniques for goat, swine and cattle

Unit 5 : Milk and Milking **4 Hrs.**

5.1 Milk and its composition
5.2 Milking methods for cow and buffaloes: hand and machine milking
5.3 Clean milk production practices

Unit 6 : Animal Nutrition and Feedstuffs **8 Hrs.**

6.1 Classification of feedstuffs: roughages and concentrates
6.2 Conventional and unconventional feeds in Nepal
6.3 Nutrients in feedstuffs
  6.3.1 Water, carbohydrates and lipids
  6.3.2 Proteins and amino acids
  6.3.3 Minerals and vitamins
6.4 Cultivation practice of common legumes and cereal forage
6.5 Introduction to the pasture/range and the high hills grazing systems in Nepal
6.6 Commonly grown fodder trees and their role in livestock feed

Unit 7 : Common Cattle and Buffalo Breeds and Their Characteristics **6 Hrs.**

7.1 Milch breeds of cattle
7.2 Dual purpose breeds of cattle
7.3 Draughts breeds of cattle
7.4 Indian and indigenous Nepalese Milch buffaloes

Unit 8 : Common Breeds of Swine, their Characteristics and Production **2 Hrs.**

Unit 9 : Common Breeds (goat and sheep) with Characteristics and Production **2 Hrs.**

Unit 10 : Housing Systems (types, floor space, consideration, merits and demerits**)** **6 Hrs.**

10.1 Housing systems for cattle and buffaloes
10.2 Housing systems for goats and sheep
10.3 Housing systems for pigs

Unit 11 : Poultry **10 Hrs.**

11.1 Common breeds (indigenous and exotic)
11.2 Formation, structure, and nutritive value of eggs
11.3 Hatching of eggs and management of incubator
11.4 Management of chicks in the brooders
11.5 Housing and equipment
11.6 Nutrition
11.7 Digestive and reproductive system

Unit 12 : Weighing and Identification of Farm Animals **2 Hrs.**

12.1 Methods for calculating live weight of different animals.
12.2 Definition and application of branding, tagging, ear knotching, and tattooing

Unit 13 : Daily Care and Management of Livestock **10 Hrs.**

13.1 Care of newborn calves

13.2 Care of breeding bulls
13.3 Care of heifers and pregnant animals
13.4 Care of diseased and sick animals
13.5 De-budding, de-horning, docking, and castration of farm animals and debeaking of poultry birds
13.6 Common ecto- and endoparasites and their control

Unit 14 : **Dairy Farm Books and Records Keeping** **2 Hrs.**

14.1 Definition, types and applications of dairy farm books and records keeping

Practical: **35 Hrs.**

S.N.	List of Tasks	Hrs.	CAM.
1	Demonstrate the digestive system of ruminants and non-ruminants through dissection.	6	5
2	Demonstrate the reproductive systems of male and female animals through dissection.	6	
3	Demonstrate the digestive system of poultry through dissection.	2	2
4	Demonstrate the reproductive system of poultry through dissection.	2	
5	Treat animals against external and internal parasites using appropriate methods.	1	2
6	Practice routine farm operations: weighing, de-budding, de-horning, ducking, tagging and castration	4	
7	Maintain records of farm animals using logbooks or digital apps.	1	1
8	Identify common grasses and forage legumes through herbarium collection.	1	
9	Formulate animal feed using Pearson's square method.	4	2
10	Restrain farm animals using casting techniques	2	1
11	Prepare Urea Molasses Mineral Block (UMMB) for livestock supplements.	3	2
12	Produce seasonal forage crops suitable for the location	3	10
Total		**35**	**25**

Learning References

- Banerjee, G. C. (1991). *A text book of animal husbandry* (7th ed.). Oxford & IBH Publishing Co.
- Prasad, J. (1997). *Animal husbandry and dairy science*. Kalyani Publishers.
- Sastry, N. S. R., Thomas, C. K., & Singh, R. A. *Livestock production management* (3rd ed.). Kalyani Publishers.

Final written exam marking scheme

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

Second year

1 English
2 Soil Fertility Management
3 Horticultural Crop Production
4 Agronomical Crop Production
5 Plant Protection
6 Extension and Communication
7 Seed Technology
8 Agricultural Project

English

Course Code: AG-201-SH

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

Lecture: 3 hours/week

Practical: 1 hour/week

Course Description:

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

Course Objectives:

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

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

Course Contents

Theory: 105 Hrs.

Part I: Language Learning 80 Hrs.

Unit 1 : Critical Thinking 4 Hrs.

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

Unit 2 Family 4 Hrs.

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

Unit 3 : Sports 4 Hrs.

3.1. Reading Comprehension: Euro game (sports related terminology, pronunciation practice and question- answer exercises
3.2. Writing news stories
3.3. Determiners and quantifiers
3.4. Asking for and giving reasons
3.5. Project work

Unit 4 : Education **4 Hrs.**

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

Unit 5 : Humor **4 Hrs.**

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

Unit 6 : Hobbies **4 Hrs.**

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

Unit 8 : History **4 Hrs.**

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

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

9.1 Reading comprehension passage: A Journey Back in Time (content words and question - answer exercises)

9.2 Writing business letters
9.3 Miscellaneous agreements
9.4 Pair work: Expressing indifference
9.5 Project work

Unit 10 : Fantasy **4 Hrs.**

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

Unit 11 : Technology **4 Hrs.**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

20.1 Reading Comprehension: An Open Letter to Mary Daly (terminologies used in politics, consonant cluster and question- answer)
20.2 Writing an article for a newspaper
20.3 Adjective order
20.4 Pair work: denying
20.5 Project work

Section Two: Literature **25 Hrs.**

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

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

Unit 2: Poems **6 Hrs.**

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

Unit 3: Essays **9 Hrs.**

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

Practical: **35 Hrs.**

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

	beginning, middle, and end.	
8	Write and present a detailed description of a person and a place. Focus on using adjectives and precise language to create a clear image.	5
Total		**35**

Learning References

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

Final written exam marking scheme

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

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

Soil Fertility Management
Course Code: AG-202-PS

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

Course description

This course provides comprehensive knowledge and skills in soil fertility management. It covers soil properties, nutrient management, organic and chemical fertilizers, biofertilizers, and related policies. It focuses on the application of soil management practices, enhancing soil fertility and crop productivity in real-world agricultural settings. The course also emphasizes sustainable practices and policy frameworks including technical roles in agriculture.

Course objectives

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

- Explain the concepts of soil, soil formation, and its physical, chemical and biological properties.
- Apply soil management practices to enhance soil fertility and crop productivity.
- Implement fertilizer management strategies for effective soil nutrient management.

Course Contents

Theory **105 Hrs.**

Unit 1 : Introduction to Soil **6 Hrs.**

1.1 Definition, importance and role of soil in crop production
1.2 Pedological and edaphological concepts
1.3 Soil and plant relationship
1.4 Soil components

Unit 2 : Soil Formation **5 Hrs.**

2.1 Definition of rocks and mineral
2.2 Weathering of rocks and minerals
2.3 Factors affecting weathering: climate, topography, parent materials, time
2.4 Soil forming factors

Unit 3 : Soil Physical Properties **6 Hrs.**

3.1 Introduction and importance of physical properties of soil
3.2 Introduction, classification and importance of soil texture, soil structure, bulk density, particle density, porosity, consistency, plasticity, soil compaction, soil crusting and soil color.

Unit 4 : Soil Chemical Properties **8 Hrs.**

4.1 Concept and significance of soil chemical properties
4.2 Soil pH: definition, factors affecting, and impact on nutrient availability
4.3 Types of soil acidity: active and exchangeable.
4.4 Saline and sodic soils: characteristics and management.

Unit 5 : Soil Biological Properties **5 Hrs.**

5.1 Introduction to soil biological properties
5.2 Classification of soil organisms
5.3 Benefits and harmful activities of soil organisms
5.4 Methods to enhance biological properties in soil

Unit 6 : Soil water, Air and Temperature **8 Hrs.**

6.1 Introduction to soil water
6.2 Physical classification of soil water: gravitational, capillary and hygroscopic
6.3 Biological classification of soil water: available, unavailable and superfluous water
6.4 Infiltration, percolation and permeability: concepts and significance
6.5 Soil aeration: importance and factors affecting
6.6 Soil temperature: importance and factors affecting

Unit 7 : Soil Classification **8 Hrs.**

7.1 Horizon designation in soils
7.2 Difference between surface and subsurface soils
7.3 Introduction and importance of soil classification
7.4 Concept of soil taxonomy
7.5 Soils of Nepal: types and distribution

Unit 8 : Plant Nutrition **15 Hrs.**

8.1 Plant nutrients: importance and historical development
8.2 Classification: macro (primary, secondary) and micronutrients
8.3 Nutrient forms, concentration, pH availability and sources
8.4 Structural nutrients: carbon, hydrogen, oxygen
8.5 Primary, secondary and micronutrients: functions, deficiency symptoms, toxicity and management

Unit 9 : Soil Fertility and Productivity **6 Hrs.**

9.1 Soil fertility: definition and factors affecting
9.2 Soil fertility status in Nepal
9.3 Soil fertility problems and management strategies
9.4 Soil productivity: definition and factors affecting

Unit 10 : Organic Manures **10 Hrs.**

10.1 Organic manures vs. chemical fertilizers: definitions and differences

10.2 Classification of organic manures
10.3 Introduction, importance, nutrient enrichment, and losses of farm yard manure
10.4 Introduction, importance, nutrient enrichment, and losses of compost
10.5 Introduction, importance, nutrient enrichment, and losses of vermicomposting
10.6 Introduction and importance of concentrated organic manures (Oil cake, Blood meal, Meat meal, Fish meal)
10.7 Introduction and importance of green manuring, green leaf manuring, and brown manuring
10.8 Biogas and its importance in Nepal
10.9 Carbon to nitrogen (C:N) ratio: impact on decomposition rates

Unit 11 : Chemical Fertilizers **6 Hrs.**

11.1 Introduction, classification, and nutrient content of nitrogenous, phosphatic, and potassic fertilizers
11.2 Secondary and micronutrient fertilizers
11.3 Suitability of different primary, secondary, and micronutrient fertilizers for specific crops

Unit 12 : Bio-fertilizers 4 **Hrs.**

12.1 Introduction and importance of biofertilizers in plant nutrition
12.2 Concept and importance of Rhizobium, Azospirillum, Azotobacter, Blue Green Algae, Azolla, Phosphate solubilizing microorganisms, and mycorrhiza-fungus root association

Unit 13 : Soil Fertility Evaluation and Soil Testing **4 Hrs.**

13.1 Importance of soil fertility evaluation and testing
13.2 Soil testing techniques in Nepal

Unit 14 : Fertilizer Recommendation and Application **4 Hrs.**

14.1 Blanket fertilizer recommendation: merits and demerits
14.2 Site-specific recommendation: merits and demerits
14.3 Nutrient use efficiency: concept and strategies
14.4 Fertilizer application methods: solid and liquid fertilizers

Unit 15 : Soil Organic Matter **6 Hrs.**

15.1 Concept of soil organic matter and soil organic carbon
15.2 Sources and factors affecting soil organic matter
15.3 Roles and importance of soil organic matter
15.4 Integrated Nutrient Management (INM): concept and benefits

Unit 16 : Soil Related Policies of Nepal **4 Hrs.**

16.1 General overview of soil related policies and stakeholders

Practical **70 Hrs.**

S.N.	List of Tasks	Hrs.	CAM
1	**Introduction to Soil**	6	5
	1.1 List and identify tools and equipment used in soil science with diagram and their uses.		
	1.2 Capture photographs and videos describing the roles of soil for classroom presentation.		
2	**Soil formation**	4	3
	2.1 Collect videos from digital platforms on rock and mineral weathering and present the process in classroom.		
3	**Soil physical properties**	12	9
	3.1 Prepare a list of tools, equipment, and laboratory apparatus for identifying soil physical properties.		
	3.2 Identify soil textural classes using a textural triangle.		
	3.3 Identify soil structures in the field.		
	3.4 Determine bulk density, particle density and porosity in the lab.		
	3.5 Calculate bulk density, particle density, porosity and their interrelationships.		
4	**Soil chemical properties**	3	2
	4.1 Measure soil pH and electrical conductivity (EC) in laboratory		
	4.2 Calculate liming requirements for acidic soils		
5	**Soil water, air and temperature**	4	3
	5.1 Measure soil moisture content in laboratory using gravimetric method/tensiometer/ electrical conductivity method.		
	5.2 Measure infiltration rate using a ring infiltrometer.		
6	**Soil classification**	6	4
	6.1 Identify surface and subsurface horizons in a 1.5 meters deep soil profile.		
	6.2 Collect soil samples from school premises and hometown with GPS coordinates using GIS tools.		
	6.3 Prepare a video interviewing five farmers on soil types and productivity; present findings in class.		
7	**Plant nutrition**	4	3
	7.1 Create a wall chart on forms, availability and concentration of plant nutrients.		
	7.2 Identify, collect and report on managing nutrient deficiencies and toxicities.		
8	**Chemical fertilizers**	2	1
	8.1 Demonstrate fertilizer manufacturing processes using digital platforms (YouTube and research papers)		

	8.2 Develop guidelines for farmers to improve fertilizer use efficiency.		
9	**Biofertilizers**	2	1
	9.1 Apply bio-fertilizers using different methods.		
	9.2 Culture rhizobium in the lab.		
10	**Soil fertility evaluation and soil testing**	**12**	9
	10.1 Identify tools, equipment's, apparatus and machines used in soil sampling and analysis.		
	10.2 Prepare soil sample for lab experiments.		
	10.3 Prepare standard solutions and reagents for soil testing.		
	10.4 Estimate soil pH, total nitrogen, available phosphorus and potassium using standard methods.		
	10.5 Conduct soil analysis using soil kit box		
11	**Fertilizer recommendation and application**	6	4
	11.1 Calculate fertilizer recommendation doses for common chemical fertilizers in Nepal.		
	11.2 Calculate nutrient use efficiency for applied fertilizers.		
12	**Soil organic matter**	6	4
	12.1 Apply integrated nutrient management (INM) approach in school farm crop production plots.		
	12.2 Study traditional INM approaches in your hometown.		
13	**Management of soil desertification of Nepal**	**3**	2
	13.1 Identify soil degradation issues in your hometown or school premises, develop and implement a management plan.		
Total		**70**	**50**

Learning References

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Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**Pr.**	**Total**
Unit Hours	6	5	6	8	5	8	8	15	6	10	6	4	4	4	6	4	**-**	**105**
Marks	4	3	4	6	3	6	6	10	4	8	4	2	2	2	4	2	10	**80**

Horticultural Crop Production

Course Code: AG-203-PS

Year: II **Total: 7 hours /week**
Theory: 3 hours/week
Practical: 4 hours/week

Course Description:

This course imparts practical skills and knowledge in the production of horticultural crops, including fruits, vegetables, and flowers. It covers crop classification, propagation, nursery management, cultivation, and harvesting, focusing on quality and productivity. The course promotes sustainable horticulture practices to contribute to Nepal's agricultural economy.

Course Objectives

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

- Explain the role of horticulture in Nepal's agricultural economy.
- Identify major horticultural crops, their classification, growth and development.
- Apply propagating, cultivating and harvesting methods for fruits, vegetables and flowers.
- Demonstrate skills in planning, managing, and evaluating horticultural crop production.

Course content

Theory **105 Hrs.**

Unit 1 : Introduction to Horticulture **5 Hrs.**

1.1 Definitions: horticulture, pomology, olericulture, floriculture, and their importance.
1.2 Scope and constraints of horticultural crop production in Nepal
1.3 Classification of horticultural crops:
  1.3.1 Vegetables: based on climatic requirements, methods of sowing and parts used.
  1.3.2 Fruits: based on agroclimatic zone in Nepal
  1.3.3 Ornamental plants: based on height, habit, blooming season, aesthetic and functional use

Unit 2 : Propagation **12 Hrs.**

2.1 Definition of propagation
2.2 Sexual and asexual propagation: definitions, advantages, and disadvantages
2.3 Dormancy and germination: concepts and factors
2.4 Asexual method of propagation
  2.41 Cuttings: root, stem (hardwood, semi hardwood, softwood, herbaceous) and leaf cutting
  2.42 Layering: tip, air layering
  2.43 Grafting: splice, whip/tongue, cleft, side, inarching
  2.44 Budding: T/shield, patch, chip
2.5 Propagation using specialized vegetative parts: bulb, corm, runner, rhizome, tuber and sucker with examples (include fruit, vegetables and ornamental plants)
2.6 Tissue culture: definition, importance and applications in horticulture

Unit 3 : **Nursery Management** **7 Hrs.**

3.1 Nursery: definition and importance in horticulture
3.2 Types of nurseries: flat, raised, hot beds for different vegetables and spices
3.3 Site selection and layout preparation for nursery bed
3.4 Manure application, bed preparation, and soil treatment (e.g. fungicides, silver nano particles)
3.5 Seed treatment and sowing techniques
3.6 Growth media: peat moss, sphagnum moss, coir, perlite, sand, soil, and their uses
3.7 Media preparation for plastic and seed trays filling
3.8 Seedling rising in plastic bags and trays
3.9 Construction of nursery tunnels for protected cultivation
3.10 Intercultural operation: mulching, weeding, irrigation, fertilizer application, plant protection, and field sanitation
3.11 Hardening and transplanting seedlings

Unit 4 : Orchard establishment **18 Hrs.**

4.1 Site selection factors:
  4.1.1 Climate and weather
  4.1.2 Soil and land slope
  4.1.3 Irrigation and drainage facilities
4.2 Orchard layout systems
  4.2.1 Square system
  4.2.2 Rectangular system
  4.2.3 Hexagonal system (Triangular system)
  4.2.4 Contour system
  4.2.5 High density planting
4.3 Windbreak and shelter belts
4.4 Selection of fruit crops and varieties
4.5 Planting season and techniques for fruit sapling
4.6 Pit digging, pit filling, staking and mulching

Unit 5 : Training and Pruning **5 Hrs.**

5.1 Definitions: training and pruning
5.2 Objectives of pruning: shape, yield, disease control
5.3 Methods of pruning: heading back, thinning out and pinching
5.4 Methods of training: center leader system, open center, modified leader
5.5 Training system of vines (kiwi and grape): overhead trellis, bower, single curtain (high/low cordon, umbrella kniffin)

Unit 6 : **Irrigation and Drainage System** **5 Hrs.**

6.1. Importance of irrigation and water requirements for fruits and vegetables
6.2. Wilting and indicator plants
6.3. Methods of irrigation: surface (ring, basin), sprinkler, drip
6.4. Drainage: effects of waterlogging and drainage methods

Unit 7 : **Commercial Vegetable Production** **18 Hrs.**

7.1 Major vegetable crops in Nepal and their importance

7.2 Production practices for

- Solanaceous: tomato, chilies, sweet pepper and eggplant
- Cole crops: cauliflower, cabbage, broccoli and kno-khol
- Cucurbitaceous: cucumber, sponge and ridge gourd, bitter gourd, pointed gourd, bottle gourd and watermelon
- Tuber/bulb crops: potato, onion and garlic
- Leafy vegetables: broad leaf mustard, spinach, cress, lettuce, coriander and swiss chard
- Root crops- radish, turnip, carrot and beetroot
- Legumes- beans, peas and cowpeas
- Others: asparagus and okra

7.2.1 Soil and nursery: soil preparation, crop rotation, nursery management, planting and spacing

7.2.2 Nutritional management and irrigation: fertilizer use, nutrient deficiency correction and critical irrigation stages

7.2.3 Harvesting: methods, quality and criteria

7.2.4 Special practices: 3G cutting, curing, pruning, mulching and grafting

Unit 8 : Off-Season Vegetable Production **7 Hrs.**

8.1 Seasonal vs. off-season production: concepts and importance in Nepal

8.2 Advantages and disadvantages

8.3 Techniques: agroclimatic variation, planting time adjustment, variety selection, controlled environments

8.4 Structures: shade net houses, rain shelters, naturally ventilated polyhouses

Unit 9 . **Cultivation Practices of Fruit Crops** **18 Hrs.**

9.1 Topics: climate, soil, cultivar, propagation, nursery, training, pruning, cultural operation, disorder, pest management, fruiting, harvesting and marketing

9.2 Crops:

9.2.1 Tropical fruits: mango, banana, pineapple, papaya, litchi, coconut and avocado.

9.2.2 Subtropical fruits: mandarin orange, sweet orange, lime, lemon, guava, pomegranate and grape.

9.2.3 Mild- temperate fruits: pear, peach, kiwi fruit, persimmon and strawberry.

9.2.4 Temperate fruits: apple and walnut.

Unit 10 : Cultivation Practices of Commercial Cut Flower and Ornamental Plants 10 Hrs.

10.1 Topics: planting time by ecological region, major varieties, propagation, seedling production, planting, special practices (pinching, disbudding), harvesting.

10.2 Crops: marigold, rose, tuberose, gladiolus, chrysanthemum carnation and orchid

Practical **140 Hrs.**

Unit	List of Tasks	Hrs.	CAM.
1	**Introduction to Horticultural Science**	10	8
	1.1 Prepare a herbarium of at least 30 fruits crops with common and Nepali name.		
	1.2 Prepare a herbarium of at least 30 vegetable crops with common and Nepali name.		
	1.3 Prepare a herbarium of at least 15 flower and ornamental crops with common and Nepali name.		
	1.4 Draw a map of Nepal and overlay major production pockets for fruits, vegetables and flowers.		
2	**Propagation of Horticultural Crops**	15	12
	2.1 Draw a labeled sketch of a flower showing its different parts		
	2.2 Practice stem cutting in rose, hibiscus, pear or in any other plants.		
	2.3 Perform air layering in litchi, guava or in any other plants.		
	2.4 Perform inarching in mango.		
	2.5 Performing T budding in rose or stone fruits		
	2.6 Identify vegetative propagation parts with examples (bulbs, corms, tubers, and rhizomes)		
3	**Nursery Management for Commercial Vegetable and Flower Production**	15	12
	3.1 Prepare different types of nursery beds.		
	3.2 Conduct seed treatment and sow seeds in nursery beds.		
	3.3 Prepare growth media (cocopeat, soil and other) and sow seeds in seed trays.		
	3.4 Prepare hot beds for seedling growth.		
	3.5 Perform intercultural operations in nurseries (mulching, weeding and irrigation).		
	3.6 Uproot, harden and transplant seedlings.		
4	**Orchard Establishment**	20	12
	4.1 Prepare an A-frame and draw contour lines for orchard planning.		
	4.2 Layout orchard systems using square, rectangular and hexagonal systems.		
	4.3 Prepare pits for planting (digging, filling with manure, and mulching).		
	4.4 Plant fruit saplings.		

5	**Training and Pruning**		8
	5.1 Practice training systems for fruit and vine crops (any two fruit among kiwifruit, grape, peach, pomegranate, apple, guava, tea, coffee and mango)		
	5.2 Practice pruning techniques on selected fruit crops.		
	5.3 Practice specific training systems (center leader, open center) in stone fruits.	10	
6	**Irrigation and Drainage Systems for Horticultural Crops**		8
	6.1 Conduct a field visit to assess irrigation needs based on plant and soil condition/indicators.		
	6.2 Practice irrigation methods: surface (ring, basin), sprinkler, and drip irrigation).	10	
	6.3 Construct and maintain drainage systems for horticultural fields.		
7	**Commercial Vegetable Production**	20	12
	7.1 Practice production package for cole/solanaceous/ cucurbits including land preparation, transplantation, irrigation, fertilization.		
	7.2 Practice three-generation (3G) cutting in cucurbits.		
8	**Off-season Vegetable Production**	10	8
	8.1 Prepare a rain shelter for tomato production during the summer rainy season in mid hills		
	8.2 Visit fields to observe off-season vegetable production under protected structures (naturally ventilated green house, greenhouse with heating cooling system, net houses)		
	8.3 Prepare a report in MS word and present findings in MS PowerPoint		
9	**Cultivation Practices of Fruit Crops**		12
	9.1 Produce sapling of fruit crops by seeds in polybags.		
	9.2 Practice harvesting techniques for fruits.	20	
	9.3 Practice grading of fruits based on size and quality.		
10	**Cultivation Practices of Commercial Cut Flower and Ornamental Plants**		8
	10.1 Prepare a field and transplant marigold seedlings.	10	
	10.2 Practice pinching, and disbudding in cut flowers (marigold or carnation).		
	10.3 Practice pruning techniques on rose plants.		

Total	**140**	**100**

Learning References

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Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Pr.**	**Total**
Unit Hours	5	12	7	18	5	5	18	7	18	10	**-**	**105**
Marks	4	9	5	11	4	4	11	5	11	6	10	**80**

Agronomical Crops Production
Course Code: AG-204-PS

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

Course description

This course provides fundamental knowledge and skills required for agronomic crop production technologies focusing on cereals, grain legumes, oilseeds, industrial crops, and underutilized crops. It addresses production status, potential, and constraints in Nepal, emphasizing climate and edaphic requirements, nutrient and irrigation management, and mechanization. The course is designed to enhance crop productivity and contribute to national food security.

Course objectives

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

- Describe the production status and constrains of agronomic crops in Nepal.
- List registered varieties of agronomic crops in Nepal.
- Explain climate and edaphic requirements for agronomic crops.
- Apply production technologies for agronomic crops grown in Nepal.
- Implement nutrient and irrigation management practices for agronomic crops.

Course Contents
Theory **105 Hrs.**

Unit 1 : Introduction of Agronomic Crop Production in Nepal **10 Hrs.**

1.1 Definition of agronomy and classification of agronomic crops
1.2 Importance and impact of green revolution on global and Nepali agriculture
1.3 Food production and food security status in Nepal
1.4 Introduction to cereals, grain legumes, oilseeds, industrial and under-utilized crops
1.5 Production status, economic importance, scope and constraints of agronomic crops in Nepal

Unit 2 : Crop Production Technologies of Major Cereals **40 Hrs.**

2.1 Rice Production Technology 12 Hrs.
2.1.1 Climate and edaphic requirement, registered varieties in Nepal.
2.1.2 Techniques of quality seed selection
2.1.3 Nursery management: dry bed, wet bed, dapog, modified dapog, tray nursery
2.1.4 Land preparation and transplanting methods
2.1.5 Major weeds
2.1.6 Plant nutrient management
2.1.7 Water and weed management strategies

2.1.8 Harvesting and storage practices
2.1.9 Insect-pests and disease management
2.1.10 Zero tillage, minimum tillage, upland rice, direct seeded rice, system of rice intensification (SRI)

2.2 Maize Production Technology 8 Hrs.
2.2.1 Climate and edaphic requirements, registered varieties
2.2.2 Land Preparation, seed selection and sowing methods
2.2.3 Plant Nutrient Management
2.2.4 Major weeds
2.2.5 Weed and water management
2.2.6 Harvesting and storage practices
2.2.7 Major insect pests and disease management
2.2.8 Winter and spring maize, intercropping and forage maize production

2.3 Wheat Production Technology 8 Hrs.
2.3.1 Climate and edaphic requirements, registered varieties
2.3.2 Land Preparation, seed selection and sowing methods
2.3.3 Plant nutrient management
2.3.4 Major weeds
2.3.5 Weed and water management
2.3.6 Harvesting and storage practices
2.3.7 Major insect pests and disease management
2.3.8 Zero-till wheat (ZT-Wheat) and minimum tillage technologies

2.4 Finger Millet and Buckwheat Production Technology 8 Hrs.
2.4.1 Climate and edaphic requirements, registered varieties
2.4.2 Seed selection and sowing
2.4.3 Land preparation and nursery management
2.4.4 Planting methods of finer millet and buckwheat
2.4.5 Harvesting and storage practices
2.4.6 Insect pest and disease management

2.5 Under-Utilized Food Crops 4 Hrs.
2.5.1 Importance and scope in Nepal
2.5.2 Status in Nepalese context
2.5.3 Cultivation practice of barley
2.5.4 Introduction to naked barley, triticale, foxtail, proso millets, pearls, sorghum, grain amaranths.

Unit 3 : Grain Legumes Production Technology 18 Hrs.

3.1 Climate, edaphic requirements and registered varieties
3.2 Cultivation Practices of:
- Winter legumes: lentil and chick pea
- Summer legumes: black gram
- Spring legumes: green gram

- Rainy season legumes: kidney bean and pigeon pea

3.2.1 Land preparation, seed selection and sowing
3.2.2 Plant nutrient management
3.2.3 Irrigation management
3.2.4 Major weeds, insect pests and disease management
3.2.5 Harvesting and storage practices
3.2.6 Intercropping with other cereals crops

Unit 4 : Oilseeds Production Technology **16 Hrs**.

4.1 Climate, edaphic requirement and registered varieties
4.2 Cultivation practices of major oilseeds crops: rapeseed, mustards, soyabean, linseed, sunflower, seasams, groundnut
4.2.1 Land preparation, seed selection and sowing
4.2.2 Plant nutrient management
4.2.3 Intercropping
4.2.4 Irrigation management
4.2.5 Weed, insect pest and disease management
4.2.6 Harvesting and storage practices

Unit 5 : Crop Production Technology of Industrial Crops **12 Hrs.**

5.1 Climate, edaphic requirements and registered varieties
5.2 Cultivation practices: sugarcane, cotton, jute and tobacco
5.2.1 Land preparation, planting material selection and sowing
5.2.2 Plant nutrient management
5.2.3 Irrigation management
5.2.4 Weed, insect pest and disease management
5.2.5 Harvesting and storage practices

Unit 6 : Mechanization in Agronomic Crop Production **5 Hrs.**

6.1 Mechanization in land preparation, sowing, planting, transplanting
6.2 Intercultural operations
6.3 Harvesting
6.4 Machinery for conservation agriculture: zero/ minimum tillage
6.5 Other agricultural machinery

Unit 7 : Storage Technology **4 Hrs**.

7.1 Traditional storage structures for food crops
7.2 Modern storage structures for food crops

Practical **70 Hrs.**

S.N.	List of Tasks	Hrs.	CAM.
1	Identify and collect different agronomic crops and their seeds.	4	3
2	Prepare fields for major agronomic crops.	4	3
3	Calculate seed requirements, perform seed treatment and sow seeds of agronomic crop.	4	3
4	Seed selection for nursery (Salt water selection) establishment in Rice.	2	1
5	Practice seed priming and sowing techniques for crops.	4	3
6	Prepare different types of rice nurseries.	6	5
7	Prepare field and transplant rice seedlings.	4	1
8	Transplant rice seedlings using system of rice intensification (SRI) technology.	2	1
9	Calculate fertilizer requirements for cereals/oilseeds/grain legumes/ industrial crops.	4	7
10	Identify and apply of different fertilizers for agronomic crops.	4	3
11	Practice irrigation methods with proper scheduling for agronomic crops.	4	3
12	Estimate yield for cereals/oilseeds/grain legumes/industrial crops.	8	3
13	Practice harvesting, threshing, drying and winnowing for agronomic crops	4	3
14	Practice storage techniques for seeds and grains of agronomic crops.	2	1
15	Practice rhizobium inoculation in grain legumes crops.	2	1
16	Observe root nodules formation in grain legumes.	2	1
17	Practice thinning, gap filling and other intercultural operation in agronomic crops	2	1
18	Identify maturity indices for major agronomic crops.	2	1
19	Conduct a field visit to observe agricultural machinery, prepare a report in MS Word and present in MS PowerPoint.	6	6
Total		**70**	**50**

Learning References

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- Gupta, O. P. (2011). *Modern weed management*. Agrobios (India).
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Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Pr.**	**Total**
Unit Hours	10	40	18	16	12	5	4	**-**	**105**
Marks	7	24	12	12	8	4	3	10	**80**

Plant Protection
Course Code: AG-205-PS

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

Course description
This course offers comprehensive knowledge and practical skills on plant health managment to enhance agricultural productivity and sustainability. It covers core principles of plant protection, including insect pest management, plant pathology, weed science, and pesticide application. The course also emphasizes integrated pest management (IPM), regulatory frameworks, and use of digital tools.

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

- Explain the fundamentals of plant protection, and Nepal's plant health system.
- Classify agricultural insect pests, their morphology, physiology, and classification, along with their ecological/economic significance.
- Diagnose plant diseases, including causal organisms, symptoms, epidemiology, and mechanisms of pathogenesis.
- Apply principles and practices of insect pest and disease management, including Integrated Pest management (IPM).
- Analyse weed characteristics and management strategies.
- Demonstrate safe and effective pesticide use.

Course Contents
Theory **140 Hrs.**

Unit 1 : Introduction to Plant Protection **5 Hrs.**

1.1 Importance and scope of plant protection in agriculture
1.2 Types of pests and their importance in crop production
1.3 Brief history of plant protection in Nepal
1.4 Role of stakeholders in Nepal's plant health system

Unit 2 : Insect and Entomology **25 Hrs**.

2.1 Brief on insect physiology: digestion, respiration, circulatory, nervous system, and reproductive system
2.2 Life cycle and stages: metamorphosis and development

2.3 Insect orders and characteristics: Thysanura, Odonata, Orthoptera, Dictoptera, Isoptera, Hemiptera, Homoptera, Coleoptera, Lepidoptera, Diptera, and Hymenoptera
2.4 Industrial insects: honey bees, silkworms, lac insects (production and benefits)
2.5 Introduction to veterinary and public health insects:
2.6 Recent advances and applications of entomology

Unit 3 : Plant Disease and Plant Pathology **10 Hrs**.

3.1 Pathogenecity and pathogenesis: mechanism of infection
3.2 Survival, dissemination and epidemiology of plant pathogens
3.3 Plant defense mechanisms: physical, chemical and systemic resistance
3.4 Disease forecasting and principles of disease management

Unit 4 : Weed Management **10 Hrs**.

4.1 Introduction, losses, and benefits of weeds
4.2 Characteristics and classification of weeds
4.3 Weed management: prevention, eradication, and control measures
4.4 Herbicides: types and application
4.5 Other pests: rodents, birds, and their management

Unit 5 : Insect Pest Management **10 Hrs**.

5.1 Principle of pest management and economic threshold level (ETL)
5.2 Pest management measures: physical, mechanical, cultural, botanical, biological, genetic/resistant varieties, regulatory and chemical
5.3 Integrated pest management (IPM): concept, principles and methods
5.4 Farmer's field school: introduction and role in IPM adoption

Unit 6 : Pesticides **10 Hrs**.

6.1 Definition and types of pesticide
6.2 Classification of pesticides
6.3 Formulation and toxicity of pesticides
6.4 Methods of pesticide application, doses, and calibration of appliances
6.5 Misuse and safe use of pesticides
6.6 Pesticide poisoning: symptoms and first aid measures

Unit 7 : Insect Pests of Crops **30 Hrs**.

7.1 Identification, life cycle, and management of insect pests for:
7.1.1 Cereals: rice, wheat, maize, millets
7.1.2 Pulses and oilseeds: lentil, mustard
7.1.3 Fruits: mango, litchi, banana, citrus, apple, pear, walnut, avocado, dragon fruit, Kiwi, and emerging fruits

7.1.4 Vegetables: cucurbits, crucifers, leafy vegetables, potato, other commercial vegetables

7.1.5 Industrial and plantation crops: cotton, jute, sugarcane, coffee, tea, ginger, cardamom

7.2 Storage grain pests and their management

7.3 Post-harvest insects and their management

Unit 8 : Crop Diseases **20 Hrs**.

8.1 Identification and management of diseases for:

8.1.1 Cereal crops: rice, wheat, maize and millets

8.1.2 Pulse and oilseeds: lentil and mustard

8.1.3 Fruits: mango, litchi, banana, citrus, apple, pear, walnut, avocado, dragon fruit, kiwi, emerging fruits

8.1.4 Vegetables: cucurbits, crucifers, leafy vegetables, potato, other commercial vegetables

8.1.5 Industrial and plantation crops: cotton, jute, sugarcane, coffee, tea, ginger, cardamom

8.2 Post-harvest diseases and management

Unit 9 : Plant Health System in Nepal **10 Hrs**.

9.1 Plant quarantine system in Nepal

9.2 World Trade Organization (WTO), International Plant Protection Convention (IPPC), International Standards for Phytosanitary Measures (ISPMs): objectives and opportunities for Nepal.

9.3 Regulatory framework:

Plant Quarantine and Protection Act 2007 and Regulation 2010

Pesticide Management Act 2019 and Regulation 2024

Unit 10 : Plant Clinic and Use of Digital Tools in Plant Protection **10 Hrs**.

10.1 Plant clinic program operation procedure, 2024

10.2 Crop pest diagnosis

10.3 Crop pest management recommendations

10.4 Operation of plant clinic

10.5 Use of digital tools in plant protection

Practical **70 Hrs.**

S.N.	List of Tasks	Hrs.	CAM.
1	Operate compound microscope to identify plant disease pathogens and insect pests.	4	3
2	Identify external morphology and appendages of insects (Examination of insect body region, insect mouth parts, antenna and their modification, photoreceptors, legs and their modification, wings and	4	3

	their modification)		
3	Dissect an insect to study its digestive, respiratory, circulatory, nervous, and reproductive systems.	4	3
4	Study the life-cycle and stages of insects using live and preserved specimens and observe feeding behavior.	4	3
5	Collect, preserve, identify and present insect specimens using pinning and mounting techniques.	4	3
6	Collect and identify crop disease symptoms.	4	3
7	Collect and identify common weeds.	4	3
8	Conduct a survey of agro-dealers to study pesticides and their applications.	4	3
9	Identify and use common plant protection appliances.	4	3
10	Calibrate a sprayer, calculate pesticide dilution and safely apply pesticides to crops.	4	3
11	Prepare Bordeaux mixture, Bordeaux paste and JHOLMAL.	4	3
12	Demonstrate the use of personal protective equipment (PPE).	4	3
13	Apply biological control practices for pest management.	4	3
14	Apply indigenous knowledge and skills for pest management.	4	3
15	Conduct a survey to identify natural enemies in crop ecosystems.	4	3
16	Conduct a field visit to identify plant diseases, insect damage and/or plant clinic operations; prepare a report in MS Word and present in MS PowerPoint.	10	5
Total		**70**	**50**

Learning References

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Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Pr.**	**Total**
Unit Hours	5	25	10	10	10	10	30	20	10	10	**-**	**140**
Marks	2	13	5	5	8	5	15	10	2	5	10	**80**

Extension and Communication

Course Code: AG-206-PS

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

Theory: 2 hours/week

Practical: 1 hour/week

Course description:

This course provides essential knowledge and skills in agricultural extension education and communication. It covers teaching learning processes, extension methods, communication strategies, adoption processes, farmers' training, leadership development, program planning, monitoring, evaluation, pluralism, gender equality, and social inclusion (GESI). The course promotes effective extension programs, fostering sustainable agricultural development in Nepal.

Course Objectives:

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

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

Theory **70 Hrs.**

Course Contents

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Unit 9 : Leadership Development 4 Hrs.

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

Unit 10 : Proposal and Report Writing 4 Hrs.

10.1 Concept, Content and Format

Unit 11 : Gender Equality and Social Inclusion (GESI) in Agriculture Development 4 Hrs.

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

Unit 12 : Pluralism in Agriculture Extension 2 Hrs.

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

Unit 13 : Group Formation and Mobilization 6 Hrs.

13.1 Groups: concept, types and importance
13.2 Group formation procedures
13.3 Group mobilization: activities, resource management
13.4 Conflict management in group

Practical 35 Hrs.

S.N.	List of Tasks	Hrs.	CAM.
1	Visit a provincial or local agriculture/livestock extension office to observe programs, interact with staff, and learn implementation mechanisms, including group formation processes.	6	5
2	Operate audio-visual equipment, LCD/LED projector, and prepare audio-visual aids for extension activities.	2	1
3	Prepare extension literature- leaflets, booklets, folder, pamphlets-news stories	2	1

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

Learning References

- Dongol, B. B. S. (2004). Extension education. Pratima Singh Dongol.
- Dahama, O. P., & Bhatnagar, O. P. (2003). Education and communication for development. Oxford & IBH Publishing Co. Pvt. Ltd.
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Final written exam marking scheme

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

Seed Technology
Course Code: AG-207-PS

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

Course description:
This course provides comprehensive knowledge and skills in seed production, processing and quality control. It covers concepts, principles, and practices of seed production, enabling learners to select quality planting materials, produce seeds, and apply quality control mechanisms in professional agricultural settings. The course also emphasizes seed physiology, certification, and legislation and explores seed business opportunities in Nepal.

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

- Describe concepts of seed production and planting materials.
- Explain seed physiology, quality and improved seed varieties.
- Apply principles of seed production for major crops.
- Perform seed processing, grading, testing and quality control.
- Interpret seed certification, legislation and intellectual property rights.
- Execute seed packaging, tagging and storage techniques.

Course Contents: **70 Hrs.**

Unit 1: Introduction to Seed and Planting Materials **4 Hrs.**

1.1. Seed vs. grain: definitions and differences
1.2. Dicot vs. monocot: definitions and distinctions
1.3. Planting materials: definition and types

Unit 2: Floral Morphology, Pollination and Propagation **7 Hrs.**

2.1 Flowering: concept, flower parts and their role in seed production
2.2 Pollination: concept, types and role in seed production.
2.3 Propagation: definition, advantages, disadvantages and types (vegetative and reproductive)
2.4 Seed types: self-pollinated, open pollinated, hybrid, GMO, LMO and terminator seeds

Unit 3: Introduction to Plant Breeding and Seed Technology **8 Hrs.**

3.1 Concept of plant breeding and its role in seed production
3.2 Seed production in Nepal: importance, scope, export/import trends
3.3 Role of quality seed in improving agriculture
3.4 Definition and importance of seed technology
3.5 Variety release and registration process in Nepal

Unit 4: Seed Biology and Physiology **7 Hrs.**

4.1. Seed germination and dormancy: types and mechanisms
4.2. Factors affecting seed germination
4.3. Factors affecting seed growth and development
4.4. Techniques for breaking seed dormancy
4.5. Concept and importance of seed viability and seed vigor.
4.6. Concept of seed longevity and causes of seed deterioration

Unit 5: Principles of Seed Production **8 Hrs.**

5.1. Principles of seed production
5.2. Field level management of seed production process
5.3. Crop specific seed production: rice, wheat, and maize
5.4. Concept, techniques, and importance of crop isolation and pollination control for seed production
5.5. Hybrid seed production techniques for maize crop

Unit 6: Seed Processing **5 Hrs.**

6.1. Precautions of seed harvesting for quality seed.
6.2. Principles of seed drying, cleaning, and grading.
6.3. Different equipment used in drying, cleaning and grading
6.4. Seed germination test for cereals, vegetables, legumes and oilseed crops in farm level

Unit 7: Handling and Storage of Seed **6 Hrs.**

7.1. Optimal storage conditions for different types of seeds
7.2. Local seed storage structures in Nepal
7.3. Packaging and labelling techniques of seeds
7.4. Transportation and distribution of quality seeds
7.5. Concept of post-harvest seed deterioration and their causes

Unit 8: Seed Quality Control **8 Hrs.**

8.1. Field requirements for standard seed production.
8.2. Institutions involved in seed quality control in Nepal.
8.3. Seed sampling techniques and necessary equipment for sampling
8.4. Roles of seed growers in quality control of seed
8.5. Roles of seed inspector and seed inspection.

Unit 9: Seed System in Nepal **6 Hrs.**

9.1. Introduction of seed system of Nepal; Formal and informal seed system.
9.2. Classification of seeds in formal seed system.
9.3. Quality seed parameters for seed certification in Nepal
9.4. Government roles in seed supply

Unit 10: Seed Legislation **8 Hrs.**

10.1 Concept, importance and objectives of seed governance
10.2 Objectives of current seed policy of Nepal
10.3 Seed Act (Provision related to Seed inspector, Seed licensing, and Punishment)

10.4 Seed sampling procedures
10.5 Introduction to Intellectual property rights

Unit 11: Seed Business in Nepal **3 Hrs.**

11.1 Status, challenges, and opportunities of seed business.
11.2 Seed marketing and distribution: strategies

Practical **70 Hrs.**

S.N.	List of Tasks	Hrs.	CAM
1	**Identification of seeds of various field crops in the laboratory**	6	4
	1.1 Draw and label the floral structure of crops and identify various parts.		
	1.2 Observe seed characteristics of crops and assess quality.		
	1.3 Visit a seed production group/company/cooperatives to learn seed production processes.		
2	**Practice in plant breeding**	6	4
	2.1 Identify male and female flowers in crops.		
	2.2 Prepare a list of self-pollinated and cross-pollinated crops.		
	2.3 Study pollination behavior of self-pollinated crops.		
	2.4 Study pollination behavior of cross-pollinated crops.		
	2.5 Apply crossing procedures for hybrid seed production in maize.		
3	**Crop field standard**	4	3
	3.1 Compare field standards for major field crops.		
	3.2 Conduct field inspection of a cereal crop seed production plot.		
4	**Seed sampling procedure**	4	3
	4.1 Identify common tools, equipment and chemicals used in seed labs.		
	4.2 Perform sampling techniques using hand and tools.		
	4.3 Prepare seed sub samples (primary, composite and guard).		
	4.4 Prepare a working sample for seed testing.		
5	**Seed moisture**	6	4
	5.1 Prepare seed moisture standards for storage of different crop seeds.		
	5.2 Measure seed moisture using the oven dry method.		
	5.3 Measure seed moisture using digital seed moisture testing devices.		

6	**Seed germination test in laboratory and field**	6	4
	6.1 Prepare tools, equipment, materials and environment for germination tests.		
	6.2 Perform germination procedures, observe, record and calculate germination rates.		
	6.3 Compare germination test results in lab and field, and draw conclusions.		
7	**Seed purity test**	2	1
	7.1 List requirements and components of seed purity testing.		
	7.2 Determine purity percentage of seed from a seed lot.		
8	**Seed viability and vigor test**	5	4
	8.1 Demonstrate methods for seed viability testing.		
	8.2 Conduct seed vigor tests in the field.		
	8.3 Observe, record and calculate seed vigor and draw conclusions.		
9	**Seed production techniques of self-pollinated crops**	12	9
	9.1 Visit a local farmers seed production field, prepare a report in MS Word and present in group by using MS PowerPoint.		
10	**Seed production techniques of cross-pollinated crops**	4	3
	10.1 Demonstrate seed production procedures for maize crops.		
11	**Visit to seed processing plant and seed testing laboratory**	6	4
	11.1 Identify improved practices for seed drying, cleaning and grading.		
	11.2 Observe commercial scale seed processing procedures.		
	11.3 Observe seed testing methods and steps in seed testing laboratory.		
	11.4 Prepare and submit an individual report in MS Word.		
12	**Study seed storage structures**	5	4
	12.1 Observe local and improved seed storage structures.		
	12.2 Identify causes of seed deterioration in storage		
	12.3 Identify the best seed storage structure for seed longevity.		
	12.4 Perform a Poster presentation on practical no.12.1, 12.2 and		
13	**Seed certification and labeling**	4	3

	13.1 Present the seed certification procedure in Nepal		
	13.2 Present the procedure for truthful labelling in Nepal		
Total		**70**	**50**

References:

- Agrawal, R. L. (2005). *Seed technology*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.
- Barsa, A. S. (Ed). (2002). *Seed quality: Basic mechanisms and agricultural implications*. The Haworth Press. Inc., USA.
- McDonald, M. B., & Copeland, L. O. (1998). *Seed production: Principles and practices*. Chapman and Hall. Inc., New York.
- Elias, S.G & Copeland, L.O., McDonald, M.B., Baalbaki, R.Z. (2012). Seed Testing: Principles and Practices. Michigan State University Press.
- Vanangamudi, K. (2020). Seed Science and Technology: An illustrated text book. New India Publishing Agency-NIPA.
- Agrawal, P.K. & Varier, A. (2019). Fundamentals of Seed Science and Technology. Brillion Publishing.

Final written exam marking scheme

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

Agricultural Project

Course Code: AG-208-PS

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

Course description:

This course offers practical competencies in agricultural production and marketing practices through hands on and project-based learning. It provides opportunities to practice in commercial agriculture, including production, branding, marketing, and value chain management using modern tools and technologies. The course fosters problem-solving, communication, teamwork, report writing, and entrepreneurial skills, preparing learners for real-world agricultural enterprises or employment.

Course objectives:

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

- Work effectively in workplace-based agricultural environment
- Address real-world agricultural challenges using farm machinery for commercial agriculture and linked with globalization and digitalization.
- Demonstrate problem solving, communication, teamwork and report writing skills.
- Apply agricultural materials, tools, equipment, machinery and technology
- Generate innovative ideas for value chains, market linkages and marketing channels
- Develop a professional work culture conducive to commercial agriculture

Project

Background

This project should be initiated and implemented at the beginning of the program with a minimum of **six projects** running throughout each academic year. Upon completion or when a batch of learners reaches the third year, the project should be handed over to the incoming batch. This approach ensures that learners gain practical experience in managing a product or service from initiation to completion, fostering competency development. It prepares learners for entrepreneurship or employment by strengthening their ability to apply skills in diverse work conditions. Income generated from project-related products or services will be managed by the production unit according to established procedures of the school.

Implementation guidelines

1 **Project selection criteria**

- Comparative advantage of technical school's practical field
- Align with social and local market needs
- Available resources of the school
- Interest and competency of instructor(s)

Operating guide lines on the basis of availability of student

Number of learner available in batch	Number of Project run	Remarks
Up to 20	3	
20 to 30	4	
30 to 40	6	

2 **Group division and allocation**

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

3 **Orientation**

Conduct orientation on:

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

Note: Schools are encouraged to develop detailed orientation guidelines based on their specific context and needs.

4 **Forms and formats**

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

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

5 **Duration:**

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

6 **Roles and responsibilities:**

Instructors: Design, execution and mentor projects
Learners: Actively participate and execute projects
Staff: Provide support
School Management: Supervision and facilitate overall implementation

7 **Assessment and Evaluation:**

Assess learners continuously on:

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

Potential list of projects (These are a few examples, but not limited to this)

Project 1: Production, branding, and marketing of compost or liquid botanical pesticides

- Produce different agricultural organic inputs.
- Develop branding and marketing strategies.
- Manage value chain through different practices.

Project 2: Commercial vegetable farming

- Cultivate different vegetables based on local climate and market demand.
- Perform site selection, seed selection, nursery management, pest/disease control, and intercultural operations.
- Market produces inside school with the involvement of learners or outside school through local vendors or cooperatives, maintaining production and sales records.

Project 3: Commercial nursery product (fruit, vegetable and flower) production and marketing

- Establish a nursery
- Practice different nursery related operations
- Sells nursery product
- Ensure quality standards.

Project 4: Commercial fruit orchard establishment, fruit production and marketing

- Select site.
- Layout the orchard.
- Cultivate fruits based on local suitability.
- Manage nursery, planting, pest/disease control, and harvesting.
- Develop marketing channels.

Project 5: Apiary establishment and honey production.

- Set-up an apiary, select bee species and manage hives.
- Process, brand, and market honey to local and urban markets.
- Maintain records of production and sales.

Project 6: Soil testing camps.

- Establish a soil testing lab to analyze soil PH and nutrients
- Provide testing services to farmers with minimal fees, interpret results, and maintain logbooks.
- Promote soil health management in local communities.

Project 7: Commercial mushroom production (at least two types).

- Cultivate mushrooms appropriate structures and spawn.
- Manage pest/disease, harvest, and market fresh/dried mushrooms.
- Keep records of production and sales.

Project 8: Seed production of local/indigenous crop varieties.

- Produce seeds of local crops.
- Apply GAP for seed purity, process, and store seeds.
- Market seeds with involvement of learners and instructor.

Project 9: Production of Value-added diversified product.

- Produce value-added products of vegetables and fruits from the school's produce or local raw materials.
- Develop processing techniques, branding, and marketing strategies.
- Analyze market potential and profitability.

Project 10: Community-based plant clinic.

- Operate plant clinic for pest/disease diagnosis and farmer consultations.
- Maintain logbooks of cases, recommendations, and outcomes.
- Use digital tools for diagnostics.

Project 11: Commercial agronomical crop production.

- Cultivate field crops based on local suitability.
- Manage seed selection, mechanization, pest control, and marketing.
- Keep detailed records of production and sales.

Project 12: High value crop production and marketing

- Produce high-value crops (e.g., cardamom, coffee, tea, ginger, *TIMUR and others*) suited to local conditions.
- Process, brand, and market products to niche markets.
- Analyze value chains and profitability.

Third Year

1 Nepali
2 Post-Harvest Technology
3 Agricultural Economics, Marketing and Cooperatives
4 High Value and Exportable Crop Enterprise
5 Urban and Organic Agriculture
6 Entrepreneurship Development
7 Internship

नेपाली

Course Code: AG-301-SH

बर्ष: तेस्त्रो

जम्मा : ३ घण्टा
सैद्धान्तिक : ३ घण्टा

कोर्षको परिचयः

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

कोर्षको उद्देश्यः

यस पाठ्यक्रमको अध्ययनबाट विद्यार्थीहरूले निम्नलिखित भाषिक क्षमताहरु विकास गर्न सक्नेछनः-

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

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

१.१ भाषिक भेदहरुको परिचय **५ घण्टा**

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

१.२ वर्ण परिचय **५ घण्टा**

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

१.३ वर्णविन्यास **५ घण्टा**

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

१.४ शब्दभण्डार **४ घण्टा**

- स्रोतका आधारमा शब्दहरुको वर्गीकरण
- बनोटका आधारमा शब्दहरुको वर्गीकरण
- कार्यका आधारमा शब्दहरुको वर्गीकरण

१.५. शब्दरूपायन **३ घण्टा**

- शब्दरूपायनको परिचय
- नामपदको रूपायन
- सर्वनामको रूपायन
- विशेषणको रूपायन

- क्रियापदको रूपायन

१.६ वाक्य संश्लेषण र विश्लेषण **२ घण्टा**

- वाक्य संश्लेषणको परिचय र अभ्यास
- वाक्य विश्लेषणको परिचय र अभ्यास

१.७ पदसङ्गति **१ घण्टा**

- पदसङ्गतिको परिचय
- पदसङ्गतिका प्रकारहरु

एकाइ दुईः लेखन सिप **३० घण्टा**

२.१ बोध लेखन **८ घण्टा**

- बोधको ज्ञान र अभ्यास

२.२ बुँदाटिप्पणी र सारांश लेखन **४ घण्टा**

- बुँदाटिप्पणी लेखन
- सारांश लेखन

२.३ संवाद वा अनुच्छेद लेखन **४ घण्टा**

- संवाद लेखन
- अनुच्छेद लेखन

२.४ व्यावसायिक पत्राचार र सूचना लेखन **५ घण्टा**

- निमन्त्रणापत्र लेखन
- सूचना लेखन
- सम्पादकलाई पत्र लेखन
- निवेदन लेखन
- विज्ञापन लेखन
- बधाईपत्र लेखन

२.५ निबन्ध लेखन **६ घण्टा**

- निबन्ध लेखनको अभ्यास

२.६ प्रतिवेदन लेखन **३ घण्टा**

- प्रतिवेदन लेखनको अभ्यास

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

३.१ निम्नलिखित ढाँचामा तलका कृति/पाठको परिचय लेख्ने अभ्यास **१८ 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 (एक अनुच्छेद)
- कृति/पाठको भाषाशैलीः (एक अनुच्छेद)

- कृति/पाठको कमी, कमजोरी र सुझावः (छोटो एक अनुच्छेद)

३.२ कृति समीक्षा **३२ घन्टा**

क) कथाखण्ड **१० घण्टा**

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

ख) निबन्ध खण्ड **१० घण्टा**

- पहाडी जीवनः लक्ष्मीप्रसाद देवकोटा
- एक पत्र- सम्पादकलाईः शङ्कर लामिछाने
- भान्सा भो हजुरः भैरव अर्याल

ग) कविता खण्ड **६ घण्टा**

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

घ) एकाङ्की **६ 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

विशिष्टीकरण तालिका

एकाइ	शीर्षक	घण्टा	पूर्णाङ्क
१	**संचारात्मक नेपाली भाषा र नेपाली व्याकरण**	**२५**	**२२**
	१.१ भाषिक भेदको परिचय	५	४
	१.२ वर्णको परिचय	५	५
	१.३ वर्णविन्यास	५	४
	१.४ शब्द भण्डार	४	३
	१.५ शब्द रुपायन	३	३
	१.६ वाक्य संश्लेषण र वाक्य विश्लेषण	२	२
	१.७ पदसङ्गति	१	१
२	**लेखन सीप**	**३०**	**२४**

	२.१ बोध लेखन	८	६
	२.२ बुँदाटिप्पणी र सारांश लेखन	४	३
	२.३ संवाद वा अनुच्छेद लेखन	४	३
	२.४ व्यावसायिक पत्राचार र सूचना लेखन	५	४
	२.५ निबन्ध लेखन	६	५
	२.६ प्रतिवेदन लेखन	३	३
३	**कृति/पाठको परिचय लेख्ने अभ्यास**	**५०**	**३४**
	३.१ कृति/पाठको परिचय लेख्ने अभ्यास	१८	१४
	३.२ कृति समीक्षा	३२	२०
	क. कथा खण्ड	१०	६
	ख. निवन्ध खण्ड	१०	६
	ग. कविता खण्ड	६	४
	घ. एकाङ्की	६	४
	जम्मा		८०

Post-harvest Technology
Course Code: AG-302-PS

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

Course Description
The course provides essential knowledge and skills in the handling, processing, storage, and marketing of agricultural products after harvesting. It emphasizes techniques and technologies that preserve freshness, extend shelf life, and minimum post-harvest losses in fruits, vegetables and other perishable commodities. The course also enables the learners to excel in post-harvest management roles within Nepal's agriculture sector and the boarder global workforce.

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

- Explain the physiological and chemical changes in horticultural commodities.
- Apply techniques to minimize post-harvest losses during harvesting, handling and marketing of horticultural commodities.
- Harvest crops at the optimal stage of maturity and perform careful handling (sorting, trimming, grading, packaging and transportation) to extend shelf life.
- Prepare value-added products such as using locally available product with relevant technology

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Course Contents

Theory

Unit 1: Scope and Importance of Postharvest Technology 8 Hrs.

1.1 History of postharvest technology, including traditional Nepali practices
1.2 Primary and secondary processing methods
1.3 Scope and importance of postharvest technology in Nepal's agricultural economy

Unit 2: Basic difference in attachment and detachment of organs 10 Hrs.

2.1 Definition and explanation of respiration
2.2 Respiration and its effect in shelf-life of harvested product
2.3 Define transpiration and explain how transpiration affects postharvest self-life
2.4 Ethylene production and its effect on post-harvest self-life
2.5 Other physical and chemical changes during ripening

Unit 3: Maturity Assessment and Harvesting 10 Hrs.

3.1 Harvesting, handling, packing house operations, and postharvest practices
3.2 Maturity indices for determining the optimal harvest time for different fruits and vegetables

3.3 Fungicide treatment, smoking, sulphuring techniques
3.4 Packaging, handling, and transportation
3.5 Commercial harvesting

Unit 4: Storage Techniques **15 Hrs.**

4.1 Principles and methods of storage
4.2 Factors affecting storage: temperature, relative humidity, gases, and pre-cooling
4.3 Methods of storage: cold storage, modified atmosphere storage, controlled atmosphere storage, cellar storage, and rustic storage

Unit 5: Processing and Preservation of Fruits and Vegetables **12 Hrs.**

5.1 Concept, history, principles, and practices of preservation, including traditional Nepali methods
5.2 Future prospects of processing and preservation industry in Nepal
5.3 Techniques of canning and bottling for value added products
5.4 Fruit beverages and juice concentrates
5.5 Sugar based products
5.6 Heat treatment and pasteurization process
5.7 Preservation using sugar, salt and other preservatives
5.8 Addition of color and flavor to preserve products

Unit 6: Post Harvest Loss Management. **15 Hrs.**

6.1 Identification of major insects, pests, diseases, and disorders affecting harvested produce
6.2 Insect and pest management for vegetables, fruits, field crops, and flowers during and post-harvest.
6.3 Management of major post-harvest disease and disorders in Nepali crops
6.4 Method for measuring post-harvest losses

Practical **35 Hrs.**

S. N.	List of Tasks	Hrs.	CAM
1	Identify laboratory equipment, tools, and chemicals used in post-harvest processing.	2	3
2	Monitor temperature and relative humidity in storage or processing areas.	2	3
3	Assess maturity of crops using indicators (colour, firmness and Total Soluble Solid).	4	1
4	Perform harvesting and grading of crops based on size, quality and market standards.	2	3
5	Harvest and prepare cut flowers for market, ensuring proper handling and presentations.	4	2
6	Package fruits, vegetables and cut flowers for local and distance	4	3

	market.		
7	Prepare potato chips using slicing, frying and seasoning techniques.	2	5
8	Prepare candy and murabba using sugar syrup and preservation methods.	3	1
9	Prepare fruit juice and squashes with appropriate preservation techniques.	3	1
10	Prepare pickle and sauces using fermentation and cooking methods.	3	7
11	Prepare jam, jelly or marmalade using fruit pulp and pectin.	4	3
12	Conduct organoleptic taste tests and hedonic rating to evaluate product quality.	2	3
Total		**35**	**25**

Learning References

- Gautam, D. M., & Bhattarai, D. R. (2012). *Postharvest horticulture*. New Plaza.
- Bautista, O. K. (1990). *Postharvest technology of Southeast Asian perishable crops*. Technology and Livelihood Resource Center.
- Kader, A. A. (2002). *Postharvest technology of horticultural crops* (3rd ed.). University of California, Agriculture and Natural Resources Publications.
- Pandey, P. H. (1997). *Postharvest technology of fruits and vegetables*. Saroj Prakashan.
- Gustavo, V. B. (2003). *Handling and preservation of fruits and vegetables by combined method for rural areas* (Technical Manual No. 149). Food and Agriculture Organization of the United Nations (FAO).

Final written exam marking scheme

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

Agricultural Economics, Marketing, and Cooperatives

Course Code: AG-303-PS

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

Theory: 2 hours/week

Practical: 2 hours/week

Course description:

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

Course objectives:

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

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

Theory:

Course Contents **70 Hrs.**

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

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

Unit 2: Factors of productions and production function **5 Hrs.**

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

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

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

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

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

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

5.1 Law of diminishing returns (LDR)
5.2 Principle of factor substitution
5.3 Principle of product substitution
5.4 Principle of comparative advantage
5.5 Principle of time comparison
5.6 Opportunity cost principle
(Emphasize on the commodities specific examples.)

Unit 6: Farm Planning and Budgetin Hrs.

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

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

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

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

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

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

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

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

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

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

11.1 Definition of market
11.2 Overview of Nepalese agricultural market system: highlights and challenges
11.3 Market information systems: definition and role in agricultural development

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

12.1 Concepts of market, marketing, and agricultural marketing
12.2 Importance of agricultural marketing in Nepal's economic development
12.3 Producer surplus, marketable surplus, marketed surplus and market intermediaries
12.4 Primary functions: assembling, processing, and dispersion
12.5 Secondary functions: standardization, grading, packaging, transportation, storage, financing, risk bearing, and selling

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

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

Unit 14: Government Intervention in Nepalese Agriculture 2 Hrs.

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

Unit 15: Cooperatives 8 Hrs.

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

Practical 70 Hrs.

S. N.	List of Tasks	Hrs.	CAM
1	Prepare a report on the economic contribution of agricultural commodities to Nepal's economy using secondary data in MS Word with data processing and tabulation (GDP, trade, food security and employment).	6	4
2	Visit a farm to assess land, labour, wages, rent status, patterns and challenges; prepare and present a group report in MS Word.	4	3
3	Calculate variable costs (VC), fixed costs (FC), total costs (TC), gross revenue, net revenue, and break-even analysis for a farm enterprise.	4	3
4	Estimate the cost of cultivation and farm income measures for two major crops or livestock.	4	3
5	Visit a nearby farm enterprise to identify key problems, propose solution and analyze resource utilization (one student per farm).	4	3

6	Determine the optimum input and output levels and least cost combination of inputs by athematic method.	4	3
7	Determine the profitable combination of products and apply the principle of equi marginal returns.	4	3
8	Prepare and analyze a simple farm plan for a smallholder farm focusing on a single crop or livestock enterprise.	4	3
9	Prepare a whole-farm budget for a diversified farm with multiple enterprises.	6	4
10	Conduct basic farm record-keeping and analysis using manual or digital tools.	2	1
11	Compute depreciation and cost of farm assets using valuation methods.	6	4
12	Conduct a case study on managing risks in monsoon-dependent farming and propose mitigation strategies.	3	2
13	Visit a well-established cooperative to analyze its structure, activities, resource mobilization, and monitoring/evaluation practices; prepare a report.	4	3
14	Visit local markets to observe marketing practices and interact with traders to analyze market functions.	4	3
15	Estimate production and marketing costs of a high-value crop (HVC) at various supply chain levels; calculate price spread, producer's share and market efficiency.	4	3
16	Identify marketing channels for food grains, pulses, oilseeds, fruits, vegetables, flowers, milk and poultry	4	3
17	Map the supply chain of a key crop or livestock commodity.	3	2
Total		**70**	**50**

Learning References:

- Chopra, P.N. (2000). *Principles of economics*. Kalyani Publishers, New Delhi.
- McConnel, C.R. (1975). *Economics: Principles, problems and policies*. McGraw-Hill, USA.
- Johl, S. S., & Kapoor, T. R. (1973). *Fundamentals of farm business management*. Kalyani Publishers, New Delhi.
- Kay, R.D., & Edwards, W. M. (1994). *Farm management*. McGraw Hill, Inc., New Delhi.
- Shankhyan, P. L. (1983). *Introduction to farm management*. Tata, McGraw-Hill, Co. Ltd., New Delhi.
- Acharya, S.S. & Agarwal, N.L. (2011). *Agricultural marketing in India* (5th ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

- Pandey, M., & Tewari, D. (2010). *The Agribusiness book: Marketing and value chain perspective*. IBDC Publisher, New Delhi.
- Broadway, A.C., & Broadway-Arif, A.A. (2008). *Textbook of agribusiness management*. Kalyani Publisher, New Delhi, India.
- Zimmerrer, T.W. & Scarborough, N.M. (2009). *Essentials of entrepreneurship and small business management.* Pearson Education.

Final written exam marking scheme

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

High Value and Exportable Crop Enterprise

Course Code: AG-304-PS

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

Theory: 2 hours/week

Practical: 1 hours/week

Course description:

This course provides comprehensive knowledge and skills required for agribusiness management, with a focus on exportable and high-value crops, livestock, dairy, and non-forest products in Nepal. It covers enterprise identification, market potential analysis, investment strategies, quality handling, human resource development, risk management and key concepts of agricultural marketing, including marketing functions, channels, supply chains and value chains. The course also explores government policies and interventions to promote exportable agricultural products. This course helps to develop and manage agribusiness ventures, contributing to Nepal's agricultural export economy.

Course objectives:

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

- Analyze the past and current exportable agricultural commodities for different countries.
- Evaluate the High value crops for production, processing and marketing for domestic and international market.
- Identify the standards require to export the agriculture commodities.
- Explain the Value chain analysis process of any agriculture.
- Analyze the constraints and challenges for export market.

Course Contents:

Theory **70 Hrs.**

Unit 1 : High Value Crops and Context in Nepal **4 Hrs.**

1.1 Concept and definition of high value crops
1.2 Existing high value crops and trade trends
1.3 Potential and demand driven high value crops for export

Unit 2 : Introduction to Agricultural and Agro Related Export Commodities 6 Hrs.

2.1 Export History of agricultural product (Brief)
2.2 Current Status of Agricultural Import and Export in Nepal
2.3 Significance of agricultural commodities in international Trade
2.4 Share of different agro products in trade
2.5 Agribusiness promotion policy

Unit 3 : Export and Import of Agricultural Commodities **8 Hrs.**

3.1 Major exportable commodities: status, importance, and future potential
3.2 Major imported commodities: status, importance and future potential
3.3 Strategies for import substitution and export promotion
3.4 Key trading partners for Nepal's imports and exports

3.5 Major bilateral trade (India, China, and Bangladesh): Status and issues

Unit 4 : Quality Control and Certification Standards 6 Hrs.

4.1 Introduction to hazard analysis critical control points (HACCP)
4.2 Certifications for global export market access
4.3 Sanitary and phytosanitary (SPS) measures (plant health, animal health, and food safety): introduction, practices, and challenges

Unit 5 : Agricultural Commodity Export Promotion Programs 4 Hrs.

5.1 Loans for export-oriented production and trading
5.2 Support for internal control systems in organic farming
5.3 Assistance for organic certification
5.4 Support for value addition, warehousing and processing plant
5.5 Start-up program of Government

Unit 6 : Existing Policy Framework 4 Hrs.

6.1 Overview of policies and legal frameworks for agricultural trade in Nepal
6.2 National Trade Integration Strategy, 2023 (Focused on agricultural commodities)

Unit 7 : Constraint and Challenges 2 Hrs.

7.1 Constraints and Challenges for export promotion
7.2 Challenges in Nepal's agri-food marketing system

Unit 8 Value Chain Development of High Value Crop 10 Hrs.

8.1 Concept of Value chain development
8.2 Value chain selection
8.3 Value chain mapping and analysis
8.4 Identification of Solutions/options
8.5 Analysis of solutions/options and selection of appropriate solution/options
8.6 Implementation
8.7 Monitoring and evaluation

Unit 9 : Comparative Advantages of High Value Commodities for Domestic and Export Markets **8 Hrs.**

9.1 High value vegetables, fruit, and flowers
9.2 Offseason vegetable and vegetable seed production
9.3 Spices, medicinal and aromatic plants (butternut tree, winter green, ayurvedic products)
9.4 Dairy and livestock products (Ghee, dog chews, and modified products)
9.5 Vegetables
9.6 Reasons for declining comparative advantage

Unit 10: Entrepreneurship Opportunities in High Value Crops and Domestic Markets 6 Hrs.

10.1 Opportunities in landscaping, gardening, floral arrangement, nursery propagation, forage seed production, and packaging

10.2 Bio-pesticides (neem cake and oil)
10.3 Small-scale enterprises in agricultural hand tool manufacturing

Unit 11: Production Technology of High Value Crop (HVC) 12 Hrs.

11.1 Tea, coffee, *MARSHI DHAN*
11.2 Ginger, turmeric, cardamom, asparagus, and *TIMUR*

Practical 35 Hrs.

S. N.	List of Tasks	Hrs.	CAM.
1	Identify major institutions and their roles in agricultural product marketing and export in Nepal.	2	1.5
2	Collect business information through interviews with a successful entrepreneur.	2	1.5
3	Prepare stakeholder mapping and analysis for high value and exportable crops.	2	1.5
4	Create a market linkage map of high value and exportable crops.	2	1.5
5	Calculate market margin, efficiency, and producer's share for a selected value chain across different marketing channels.	2	1.5
6	Develop a risk assessment matrix for an export agribusiness.	2	1.5
7	Prepare business plans for two export agribusinesses.	2	1.5
8	Conduct product or service identification and selection using the SWOT analysis method.	2	1.5
9	Develop a value chain map with backward and forward linkages for HVCs.	2	1.5
10	Prepare an action plan for a business startup.	2	1.5
11	Conduct production, processing, packaging, branding, and marketing of two high value/ export potential crops.	15	10
Total		**35**	**25**

Learning References

- Acharya, S. S., & Agarwal, N. L. (2011). *Agricultural marketing in India* (5th ed.). Oxford and IBH Publishing Co. Pvt. Ltd.
- Pandey, M., & Tewari, D. (2010). *The agribusiness book: Marketing and value chain perspective*. IBDC Publishers.
- Broadway, A. C., & Broadway-Arif, A. A. (2008). *Textbook of agribusiness management*. Kalyani Publishers.

Final written exam marking scheme

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

Urban and Organic Agriculture

Course Code: AG-305-PS

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

Course description:

This course provides basic knowledge and skills in urban and organic agriculture to promote food security, reduce greenhouse gas emissions, and improve soil quality through sustainable practices. It covers urban farming, organic certification, soil-less systems and climate smart agriculture, to generate employment and trade opportunities in Nepal and other developing countries.

Course objectives:

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

- Explain the concept, principles and techniques of urban and organic farming
- Analyze urban and organic farming's role in improving food security through home grown food production
- Evaluate trends and trade opportunities for organic products in developing countries
- Engage with organic farmers and analyze government policies and support programs for organic trade.
- Apply organic certification processes and procedures in Nepal

Course Contents

Theory **70 Hrs.**

Unit 1 : Food Safety **4 Hrs.**

1.1 Food safety: concept and definition
1.2 Importance and pillars of food safety
1.3 Food Safety concern in Nepal
1.4 Food Safety policies in Nepal

Unit 2 : Food Security in Nepal **4 Hrs.**

2.1 Food Security: definition, dimension and measurement
2.2 Current situation: urban vs. rural food insecurity in Nepal
2.3 Acute vs chronic food security: causes and impacts

Unit 3 : Urban Agriculture **5 Hrs.**

3.1 Urban agriculture: concept, definition and history
3.2 Benefits: food security, employment, environmental sustainability
3.3 Types of urban agriculture
3.4 Current status of urban agriculture in Nepal

Unit 4 : Home Gardening **15 Hrs.**

4.1 Importance and scope: home gardens, kitchen gardens and rooftop farming
4.2 Characteristics of home garden, kitchen garden, rooftop farming

4.3 Components of home garden, kitchen garden, rooftop farming
4.4 Materials and equipment: pots, growth media, staking, plant protection tools
4.5 Layout preparation: design for optimal sunlight and space
4.6 Site selection and design of home and rooftop garden
4.7 Crop selection: leafy, root, fruit, legume, cole crops
4.8 Crop calendar: year-round vegetable and fruit production.

Unit 5 : Organic Agriculture **15 Hrs.**

5.1 Organic agriculture: concept and definition
5.2 Principles of organic agriculture
5.3 Importance, scope, and opportunities
5.4 Types and objectives of organic agriculture
5.5 Components of organic agriculture
5.6 Benefits and threats of organic agriculture
5.7 Global status: organic market trends
5.8 National status: organic farming areas
5.9 Government interventions: subsidies and research
5.10 Trade opportunities for organic products
5.11 Organic certification in Nepal: standards, procedures

Unit 6 : Sustainable Agricultural Systems **6 Hrs.**

6.1 Sustainable agriculture: concept, definition and history
6.2 Principle and technique of sustainable agriculture
6.3 Indicators of sustainability
6.4 Needs and challenges of sustainable agriculture

Unit 7 : Soil-less Farming **6 Hrs.**

7.1 Hydroponics: principles, methods, applications
7.2 Aquaponics: integration of fish and plant production
7.3 Aeroponics: mist-based nutrient delivery, applications

Unit 8 : Waste Management **5 Hrs.**

8.1 Composting and renewable energy technologies
8.2 Urban agriculture and agroecology: waste recycling, soil fertility
8.3 Sustainable local food systems: farm to table models

Unit 9 : Urban Agriculture Start-Up **5 Hrs.**

9.1 Urban -farm infrastructure
9.2 Production systems
9.3 Business planning
9.4 Land/water access and costs
9.5 Capital and financing
9.6 Market development

Unit 10 : Climate Smart Agriculture **5 Hrs.**

10.1 Carbon farming: practices
10.2 Climate risk mapping: tools for vulnerability assessment
10.3 Carbon trading: concepts, opportunities in Nepal
10.4 Climate-resilient practices

Practical **70 Hrs.**

S. N.	List of Tasks	Hrs.	CAM
1	Design and perform the layout of a kitchen garden	4	3
2	Identify and prepare a list of materials and equipment used for rooftop farming.	2	2
3	Prepare a crop calendar for year-round vegetable supply in Nepal's agroecological zones.	4	3
4	Grow suitable crops for kitchen garden.	10	6
5	Identify and list vegetables and fruit varieties suitable for rooftop farming.	2	2
6	6.1 Visit an organic farm to observe principles and techniques. 6.2 Prepare a report of the organic farm visit in MS Word and present findings using MS PowerPoint.	12	9
7	Prepare vermicompost using earthworms.	9	5
8	Cultivate vegetable crops using hydroponics/ aeroponics/ aquaponics techniques	8	6
9	9.1 Develop a business plan for an urban agriculture startup. 9.2 Present the business plan in class using MS PowerPoint or MS Excel.	8	7
10.	Prepare and apply plant-based pesticides for rooftop/kitchen gardening.	6	4
11	Prepare and present a waste management plan for kitchen gardening.	5	3
	Total	**70**	**50**

Learning References:

- Urick, D. N. *The urban tiller: An investigation into the urban agricultural system of Kathmandu, Nepal* (Master's thesis). Michigan State University
- Timsina, J. (Ed.). (2022). *Agriculture, natural resources and food security: Lessons from Nepal*. Springer
- Singh, M., & Maharjan, K. L. (2017). *Sustainability of organic farming in Nepal*. Springer.
- Sharma, G. (2005). *Organic agriculture in Nepal: An analysis into status, policy, technology, and psychology*. Paper presented at the National Workshop on Organic Agriculture and Food Security, Kathmandu, Nepal.
- ANSAB. (2016). *Toolkit on organic farming practices* [Nepali version]. Asia Network for Sustainable Agriculture and Bio-resources

Final written exam marking scheme

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

Entrepreneurship Development
Course Code: AG-306-MG

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

Course Description

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

Course Objectives

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

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

Course contents

Theory **35 hrs.**

Unit 1: Introduction to Entrepreneurship 8 Hrs.

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

Unit 2: Creativity and Assessment 6 Hrs.

2.1 Concept of creativity

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

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

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

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

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

Practical: **70 Hrs.**

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

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

Internship

Course Code: AG-307-PS

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

Course Description

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

Objectives

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

- Understand job roles and work environments in agriculture-related fields.
- Apply academic skills in practical settings, such as farm management and research.
- Acquire new skills not covered in the curriculum, such as problem solving.
- Explore job market opportunities and plan career paths accordingly.

Learning Key Areas

General Learning Areas

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

Specific Learning Areas

S.N.	Institution/Area	Learning Activities
1	**Farms (Government/Private)**	• Managing nurseries and orchards • Practice propagation techniques: Cutting, layering and grafting • Perform intercultural operations: training, pruning, weeding, manuring, Bordeaux mixture/ paste application • Explore new technologies: high yielding varieties, drip irrigation, automated

		equipment's
2	**Research Stations**	• Understand research layout, tagging, isolation distance • Collect, record, analyze data: evaluate result • Study types of tests/research (e.g., varietal trials). • Learn about demonstrated varieties and technologies. • Participate in seed production processes. • Study germplasms and breeding lines.
3	**Laboratories (Central/Provincial/Research)**	• Familiarize with lab equipment • Operate lab equipment for testing. • Prepare and handle samples for analysis (e.g., soil, plant tissue). • Understand and interpret test results. • Conduct tests independently (e.g., seed viability tests). • Crop pests identification/Preservation
4	**Local Level Agriculture related Offices**	• Manage daily agricultural and livestock service operations. • Address farmers' queries (e.g., pest management). • Conduct crop cutting and yield estimation (e.g., rice yield). • Assist farmer training sessions. • Assist to distribute inputs: seeds, pesticides, fertilizers.
5	**Prime Minister Agriculture Modernization Project (Blocks, Zones, Super Zones)**	• Collect farmers' demands (e.g., agri inputs seed varieties). • Assess farmers' capacities for technology adoption. • Assist trainings and workshops (e.g., IPM). • Demonstrate technologies (e.g., precision farming). • Operate modern machinery (e.g., combine harvesters).
6	**Agriculture Knowledge Centers (AKC)**	• Support office for agriculture and livestock extension services.

		• Learn from entrepreneurial case studies (e.g., cooperative models). • Assist project selection, implementation, and monitoring for subsidies.

Activities plan

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

Evaluation

S. N	Evaluator	Marks
1	Supervisor at internship organizations	200
2	Training Institute	200
3	CTEVT or its nominee (external)	100
	Total	**500**

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

Government Organization in the Agriculture Sector

The following list of government organizations is provided as a guideline for internship placement. However, eligible internship sites are not limited to these entities; other

government organizations, INGOs, NGOs, and private commercial farms may also be considered, provided they align with the objectives and requirements of the internship.

Federal

- *Ministry of Agriculture and Livestock Development*
- *Department of Livestock Services*
- *Department of Food Technology and Quality Control*
- *Nepal Agricultural 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*

Acknowledgement

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Experts		
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3	Ms. Anuma Bhattrai	Ministry of Agriculture and Livestock Development
4	Mr. Madhab Poudel	Prime Minister Agriculture Modernization Project
5	Mr. Sujit Poudel	Ministry of Agriculture and Livestock Development
6	Mr. Prakash Kumal	Ganeshman Memorial Polytechnic Institute
7	Mr. Subash Oliya	Barpak Polytechnic Institute
8	Mr. Rajendra Devkota	Sector Skill Committee, Agriculture
9	Mr. Ramesh Baidhya	Khwopa Agro Concern and Research Centre
10	Mr. Prabin Sinatakola	Basu Secondary School, Bhaktapur
11	Mr. Dhruba Raj Regmi	Native Nepali Agro Supplies
12	Mr. Ravikiran Adkhikari	Prime Minister Agriculture Modernization Project
13	Mr. Indra Sharma Dhungana	Prime Minister Agriculture Modernization Project
14	Mr. Nabin Subedi	Madan Ashrit Memorial Technical School
15	Mr. Uttam Sharma Luitel	Training Institute for Technical Instruction
16	Mr. Anup Neupane	National Skill Testing Board
17	Mr. Tribhivan Chaudhary	Turanng Polytechnic Institute
18	Mr. Santosh Pd. Adhikari	Ramechhap Polytechnic Institute
19	Mr. Bimal Acharya	Ramechhap Polytechnic Institute
20	Mr. Prakash Paneru	Nepal Agriculture Research Council
21	Mr. Yogendra Acharya	Nepal Agriculture Research Council
22	Mr. Subah Kumar Jha	Department of Agriculture
23	Mr. Dipendra K. Mandal	Bee Development Centre
Facilitators		
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