

**CURRICULUM**  
**for**  
**Diploma in Agriculture (Plant Science)**  
**[Intermediate of Science in Agriculture-Major in Plant Science]**  
**(Three-year program-semester system)**



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

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## **Introduction**

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

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

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

## **Curriculum Title**

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

## **Program Aim**

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

## **Program Objectives**

The curriculum has following objectives:

1. Provide agronomy, horticulture and plant protection services to local farmers and different scales of farming;
2. Deliver extension and community development services as a front-line extension workers;
3. Conduct farmers training as a local level resource person for increasing productivity of land, plant protection, land management, soil management, fertilizer application and new technology adaptation;
4. Carryout agribusiness management and cooperatives services at rural and urban areas in public and private sectors;
5. Promote various aspects of agriculture such as plant breeding, commercial vegetable production, mushroom cultivation, fruit crops production, medicinal plant production and aquaculture and fisheries;

6. Promote organic and offseason vegetables production technology, culture and farming system;
7. Communicate effectively and work collaboratively in multidisciplinary and multicultural work environments through recognizing and understanding global, environmental, social, and ethical contexts of their works; and
8. Enable to prepare business plan for establishing small scale production and service related agro-enterprise firms.

### **Program Description**

This course is based on the job required to perform by the Junior Technicians (JT) at different levels of public and private sectors of Agriculture and community development related works in Nepal. Therefore, this curriculum is designed to provide knowledge and skills focusing on Agriculture Plant Science related to the occupation. There are six semesters in total within the period of three years. The first year courses are offered focusing on foundational and core academic subjects of Agriculture science; the second year courses are focused on basic disciplinary subjects of Agriculture Plant Science. Similarly, the third year whole courses comprise of the disciplinary subjects related to Agriculture Extension, Crop Production, and Seed Technology and so on. Moreover, the third year insists on the application of learned skills and knowledge through the project work and Internship Program. . The curriculum structure and the subject wise content that reflect the details of this curriculum. In brief, this curriculum will guide to its implementers to produce competent and highly employable middle level technical workforces in the field of Agriculture.

The contents of each subject prescribed in the curriculum are founded in “must know and must do” principle. The contents of the curriculum are comprehensively described in microlevel.

### **Rationale of Revision**

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

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

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

### **Program Duration**

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

### **Target location**

The target location is all over Nepal

### **Group size**

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

### **Target Group**

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

### **Entry Qualification**

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

### **Medium of Instruction**

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

### **Pattern of Attendance**

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

### **Teacher and Student Ratio**

The ratio between teachers and students must be:

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

### **Qualification of Instructional Staff**

- The program coordinator should be a master's degree holder in the related subject area.
- The disciplinary subject related teachers and demonstrators should be a bachelor's degree holder in the related subject area.
- The foundational subjects (core and academic courses) related teacher should be master degree holder in the related subject area.

### **Instructional Media and Materials**

The following instructional media and materials will be used:

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

### **Teaching learning methodologies**

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

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

### **Approach of Learning**

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

### **Examinations and Marking Scheme**

#### **a. Internal assessment**

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

#### **b. Final examination**

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

#### **c. Requirement for final practical examination**

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

**d. Final practicum evaluation will be based on:**

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

**e. Pass marks:**

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

**Provision of Back Paper**

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

**Disciplinary and Ethical Requirements**

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

**Grading System**

The grading system will be as follows:

<u>Grading</u>	<u>Overall marks</u>
• Distinction:	80% and above
• First division:	65% to below 80%
• Second division:	50 % to below 65%
• Pass division:	Pass marks to Below 50%

## Certificate Awarded

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

## Career Path

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

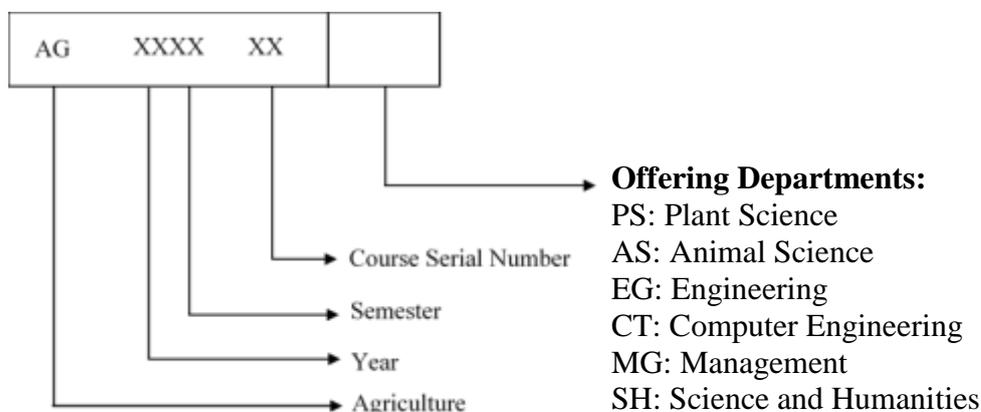
## General Attitudes Required

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

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

## Subjects Codes

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



## Curriculum Structure

### Diploma in Agriculture (Plant Science)

#### [Intermediate of Science in Agriculture-Major Plant Science]

**Year/ Semester: I/I**

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

**Year/ Semester: I/II**

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

**Year/ Semester: II/I**

S.N.	Code No.	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	Theory			Practical				
			L	T	P	Lab			Assmt. Marks	Final		Assmt. Marks	Final			
							Marks	Time (Hrs.)		Marks	Time (Hrs.)					
1	AG2101PS	Fundamentals of Horticulture	4		2		6	5	20	80	3	30	20	3	150	*continuous assessment
2	AG2102PS	Agro-metrology and Environmental Science	2		2/2		3	3	10	40	1.5	25	0	0	75	
3	AG2103PS	Irrigation, Farm Mechanization and Farm Structure	2		2/2		3	3	10	40	3	25	0	0	75	
4	AG2104PS	Fundamentals of Agronomy	4		2		6	5	20	80	3	30	20	3	150	
5	AG2105PS	Agriculture Entomology	5		4		9	7	20	80	3	60	40	4	200	
6	AG2106PS	Fundamentals of Soil Science	4		2		6	5	20	80	3	30	20	3	150	
7	AG2101AS	Introductory Animal Husbandry	4		2		6	5	20	80	3	30	20	3	150	
<b>Total</b>			<b>25</b>		<b>12</b>		<b>39</b>	<b>32</b>	<b>130</b>	<b>520</b>		<b>200</b>	<b>100</b>		<b>950</b>	

**Year/ Semester: II/II**

S.N.	Code No.	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	Theory			Practical				
			L	T	P	Lab			Assmt. Marks	Final		Assmt. Marks	Final			
							Marks	Time (Hrs.)		Marks	Time (Hrs.)					
1	AG2201PS	Soil Fertility Management	4		2		6	5	20	80	3	30	20	3	150	*continuous assessment
2	AG2202PS	Cereal Crop Production	2		2		4	3	10	40	1.5	30	20	3	100	
3	AG2203PS	Plant Pathology and Mushroom Cultivation	3		2/2		4	4	20	80	3	25			125	
4	AG2204PS	Vegetable and Spice Crop Production	5		2		7	6	20	80	3	30	20	3	150	
5	AG2205PS	Fundamentals of Aquaculture and Fisheries	3		2		5	4	20	80	3	30	20	3	150	
6	AG2206PS	Agri- Economics and Farm Management	4		2		6	5	20	80	3	30	20	3	150	
7	AG2207PS	Industrial Crops	3		2		5	4	20	80	3	30	20	3	150	
<b>Total</b>			<b>24</b>		<b>13</b>		<b>38</b>	<b>31</b>	<b>130</b>	<b>520</b>		<b>210</b>	<b>140</b>	<b>21</b>	<b>1000</b>	

**Year/ Semester: III/I**

S.N.	Code No.	Subject	Teaching Scheme					Examination Scheme					Total Marks	Remarks		
			Mode				Weekly Hours	Credit Hours	Theory			Practical				
			L	T	P	Lab			Assmt. Marks	Final		Assmt. Marks			Final	
										Marks	Time (Hrs.)				Marks	Time (Hrs.)
1	AG3101PS	Medicinal Plants and NTFP	2		2		4	3	10	40	1.5	30	20	3	100	*continuous assessment
2	AG3102PS	Grain legumes and Oilseed Crops	2		2		4	3	10	40	1.5	30	20	3	100	
3	AG3103PS	Fruit Crop Production	4		2		6	5	20	80	3	30	20	3	150	
4	AG3104PS	Post-Harvest Technology	3		2		5	4	20	80	3	30	20	3	150	
5	AG3105PS	Agriculture Extension and communication	4		2		6	5	20	80	3	30	20	3	150	
6	AG3106PS	Agribusiness, Marketing and Cooperative	2		2/2		3	3	10	40	1.5	25	0		75	
7	AG3107PS	Ornamental Horticulture	3		2		5	4	20	80	3	30	20	3	150	
8	AG3108PS	Seed Technology	3		2		5	4	20	80	3	30	20	3	150	
		<b>Total</b>	<b>21</b>		<b>13</b>		<b>38</b>	<b>28</b>	<b>120</b>	<b>480</b>		<b>205</b>	<b>120</b>		<b>925</b>	

**Year/ Semester: III/II**

S.N.	Code No.	Subject	Teaching Scheme					Examination Scheme					Total Marks	Remarks		
			Mode				Weekly Hours	Credit Hours	Theory			Practical				
			L	T	P	Lab			Assmt. Marks	Final		Assmt. Marks			Final	
										Marks	Time (Hrs.)				Marks	Time (Hrs.)
1	AG3201PS	Elementary Agriculture Statistics	2	1			3	2	10	40	1.5				50	*continuous assessment
2	AG3202PS	Social Mobilization and Community Development	3		2		5	4	20	80	3	30	20	3	150	
3	EG3201MG	Entrepreneurship Development	3		2		5	4	20	80	3	30	20	3	150	
4	AG3204PS	Internship (Farm Practice Training)			26		26	13				200	100		300	
		<b>Total</b>	<b>8</b>	<b>1</b>	<b>30</b>		<b>39</b>	<b>23</b>	<b>50</b>	<b>200</b>		<b>260</b>	<b>140</b>		<b>650</b>	

**First Year/ First Semester**

नेपाली  
१९०९ एस.एच.

वर्ष: प्रथम  
खण्ड: प्रथम

जम्मा: ४ घण्टा/हप्ता  
प्रवचन: ४ घण्टा/हप्ता

**कोर्षको परिचय:**

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

**कोर्षको उद्देश्य:**

यस पाठ्यांशको अध्ययनबाट विद्यार्थीहरूले निम्न लिखित भाषिक क्षमता विकास गर्न सक्नेछन्:-

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

**एकाइ १: संचारात्मक नेपाली भाषा र नेपाली व्याकरण**

१४ घण्टा

**१.१ भाषिक भेदको परिचय**

३ घण्टा

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

**१.२ वर्णको परिचय**

२ घण्टा

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

**१.३ वर्ण विन्यास**

२ घण्टा

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

**१.४ शब्द भण्डार**

३ घण्टा

- स्रोतका आधारमा शब्दको वर्गीकरण
- बनोटका आधारमा
- कार्यका आधारमा

**१.५. शब्द रूपायन**

२ घण्टा

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

**१.६ वाक्य संश्लेषण र वाक्य विश्लेषण**

१ घण्टा

- वाक्य संश्लेषण
- वाक्यविश्लेषण

**१.७ पदसङ्गति**

१ घण्टा

• पदसङ्गतिको परिचय	
• पदसङ्गतिका प्रकार	
एकाइ दुई: लेखन सिप	२२ घण्टा
२.१ लेखन सिप	६ घण्टा
• बोधको ज्ञान र अभ्यास	
२.२ लेखन सिप	३ घण्टा
• बुँदाटिपोट	
• सारांश लेखन	
२.३ लेखन सिप	३ घण्टा
• संवाद लेखन	
• अनुच्छेद लेखन	
	(कुनै एक)
२.४ लेखन सिप	४ घण्टा
• निमन्त्रणापत्र	
• सूचना	
• सम्पादकलाई चिठी	
• निवेदन	
• विज्ञापन	
• बधाई ज्ञापन	
	(कुनै एक)
२.५ लेखन सिप	४ घण्टा
• निबन्ध लेखन	
२.६ लेखन सिप	२ घण्टा
• प्रतिवेदन लेखन	
एकाइ ३: कृति/पाठ परिचय र कृति समीक्षा	२४ घण्टा
३.१ निम्नलिखित ढाँचामा तलका कृति/पाठको परिचय लेख्ने अभ्यास	६ घण्टा
क) कृतिहरू:	
• म कसरी हार्छु (नाटक)	गोविन्दबहादुर मल्ल गोठाले
• माइतघर (उपन्यास)	लैनसिंह वाङ्देले
• राष्ट्रनिर्माता (खण्डकाव्य)	माधवप्रसाद घिमिरे
ख) कृति परिचयको ढाँचा	
• कृति/पाठको नाम:	
• कृति/पाठको रचनाकारको नाम:	
• कृति/पाठको मुख्य विषय: (एक अनुच्छेद)	
• कृति/पाठको महत्व: (एक अनुच्छेद)	
• कृति/पाठले आफूलाई पारेको प्रभाव: (छोटो एक अनुच्छेद)	
• कृति/पाठको भाषाशैली: (छोटो एक अनुच्छेद)	
• कृति/पाठको कमी, कमजोरी र सुझाव: (छोटो एक अनुच्छेद)	
३.२ कृति समीक्षा	१८ घण्टा
क) कथाखण्ड	५ घण्टा
• हरिदत्त:	विश्वेश्वरप्रसाद कोइराला
• बितेका कुरा:	रुपनारायण सिंह
• मृगतृष्णा:	माया ठकुरी
ख) निबन्ध खण्ड	५ घण्टा
• पहाडी जीवन:	लक्ष्मीप्रसाद देवकोटा

- एक पत्र— सम्पादकलाई: शङ्कर लामिछाने
  - भान्सा भो हजुर: भैरव अर्याल
- ग) कविता खण्ड ४ घण्टा
- साहित्य सुधा: धरणीधर कोइराला
  - हामी: भूपी शेरचन
  - नचिनिने भएछौं: अगमसिंह गिरी
- घ) एकाङ्की ४ घण्टा
- भावना: भीमनिधि तिवारी

#### सिकाइ सामग्रीहरू

- कृष्णप्रसाद पराजुली: राम्रो रचना मीठो नेपाली, सहयोगी प्रेस
- दयाराम श्रेष्ठ र मोहनराज शर्मा: नेपाली साहित्यको सङ्क्षिप्त इतिहास, साझा प्रकाशन
- डा. मोहन विक्रम थापा: साहित्य परिचय, साझा प्रकाशन
- विश्वेश्वरप्रसाद कोइराला: दोषी चस्मा कथा सङ्ग्रह, साझा प्रकाशन
- माधवप्रसाद घिमिरे: राष्ट्र निर्माता खण्डकाव्य, साझा प्रकाशन
- लैनसिंह वाङ्देल्: माइतघर उपन्यास, रत्न पुस्तक भण्डार
- गोविन्दबहादुर मल्ल गोठाले: भोको घर एकाङ्की सङ्ग्रह, साझा प्रकाशन
- व्यावहारिक नेपाली, टीकाहरि बराल, अस्मिता बुक्स पब्लिसर्स एण्ड डिस्ट्रिब्युटर्स प्रा.लि.पुतलीसडक काठमाडौं
- गोरखापत्र, कान्तिपुर आदि पत्रिका सम्पादकीय, टिप्पणी र लेखहरू
- प्रशिक्षकहरूले आफ्नो पुस्तक तयार गर्न वा बजारमा पाइने सामग्री छानेर पढाउन सक्ने

#### विशिष्टीकरण तालिका

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

**English I**  
**1102 SH**

**Year: I**  
**Semester: I**

**Total: 4 hours /week**  
**Lecture: 4 hour/week**  
**Practical: hours/week**

**Course Description:**

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

**Course Objectives:**

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

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

**Section One: Language Development**

**40 Hrs.**

**Unit 1: Critical thinking**

**4 Hrs.**

- 1.1 Reading Comprehension: Know Thyself
  - 1.1.1 Terminologies of thinking skills
  - 1.1.2 Question – answer
- 1.2 Writing Email
- 1.3 Question Tag
- 1.4 Dialogue: Expressing disappointment.
- 1.5 Project Work

**Unit 2: Family**

**4 Hrs.**

- 2.1 Reading Comprehension: Family
  - 2.1.1 Family related terminologies.
  - 2.1.2 Root words and prefixes
  - 2.1.3 Question - answer
- 2.2 Writing Essay
- 2.3 Modal Verbs
- 2.4 Arguing /defending a point
- 2.5 Project Work

**Unit 3: Sports**

**4 Hrs.**

- 3.1. Reading Comprehension: Euro 2020
  - 3.1.1 Use of sports related terminologies
  - 3.1.2 Pronunciation
  - 3.1.3 Question- answer
- 3.2. Writing a news story
- 3.3. Determiner and Quantifier

- 3.4. Asking for and giving reason
- 3.5. Project Work

**Unit 4: Education** **4 Hrs.**

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

**Unit 5: Humor** **4 Hrs.**

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

**Unit 6: Hobbies** **4 Hrs.**

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

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

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

**Unit 8: History** **4 Hrs.**

- 8.1 Reading Comprehension: After the World Trade Centre
  - 8.1.1 Definition of Professional words
  - 8.1.2 Question- answer
- 8.2 Description of an event
- 8.3 Preposition
- 8.4 Simple future, future continuous, future perfect and future perfect continuous
- 8.5 Pair work: Speculation

## 8.6 Project Work

### **Unit 9: Leisure and Entertainment**

**4 Hrs.**

#### 9.1 Reading Comprehension passage: A Journey Back in Time

9.1.1 Content Words

9.1.2 Question - answer

#### 9.2 Business letter

#### 9.3 Miscellaneous agreements

#### 9.4 Pair work: Expressing indifference

#### 9.5 Project Work

### **Unit 10: Fantasy**

**4 Hrs.**

#### 10.1 Reading Comprehension: The Romance of a Busy Broker

10.1.1 Finding meaning in a dictionary

10.1.2 Terminologies used in the stock market

10.1.3 Question - answer

#### 10.2 Writing Summary

#### 10.3 Relative Clause

#### 10.4 Describing process

#### 10.5 Project Work

## **Section Two: Literature**

**20 Hrs.**

### **Unit One: Short Stories**

1. Neighbors - Tim Winton

2. A Respectable Woman - Kate Chopin

3. A Devoted Son - Anita Desai 189

### **Unit Two: Poems**

1. A Day - Emily Dickinson

2. Every Morning I Wake - Dylan Thomas

3. I Was My Own Route - Julia de Burgos

### **Unit Three: Essays**

1. On Libraries - Oliver Sacks

2. Marriage as a Social Institution - Stephen L. Nock

### **References:**

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

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

### Final written exam marking scheme

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

## Mathematics I

(1103SH)

**Year: I**  
**Semester: I**

**Total: 6 hours /week**  
**Lecture: 5 hours/week**  
**Tutorial: 1 hour/week**  
**Practical: hours/week**  
**Lab: hours/week**

### Course description:

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

### Course objectives:

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

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

### Course Contents:

#### Unit: 1: Set, Relation and Function

**10 Hrs.**

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

#### Unit: 2: Trigonometry

**15 Hrs.**

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

#### Unit: 3: Algebra

**10 Hrs.**

- 3.1 Progressions:
  - A.P, G.P and H.P
- 3.2 Means
  - A.M, G.M and H.M
- 3.3 Sum of infinite geometric series
- 3.4 Sum of natural number
- 3.5 Polynomial equations:
  - Quadratic equation

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

**Unit: 4: Co-ordinate Geometry**

**15 Hrs.**

4.1 Straight lines:

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

4.2 Pair of straight lines:

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

4.3 Circle

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

**Unit: 5: Calculus**

**25 Hrs.**

5.1 Limits and continuity

5.2 Derivatives:

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

5.3 Indefinite integrals:

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

5.4 Definite integral

**Recommended textbooks:**

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

**Evaluation Scheme**

**Unit wise Marks division for Final Exam**

S. N.	Units	Short questions (2 marks)	Long questions (4 marks)	Total Marks
1.	Set, Relation and Function	$2 \times 2 = 4$	$1 \times 4 = 4$	8
2.	Trigonometry	$3 \times 2 = 6$	$2 \times 4 = 8$	14
3.	Algebra	$3 \times 2 = 6$	$3 \times 4 = 12$	18
4.	Coordinate Geometry	$2 \times 2 = 4$	$3 \times 4 = 12$	16
5.	Calculus	$4 \times 2 = 8$	$4 \times 4 = 16$	24
		<b><math>14 \times 2 = 28</math></b>	<b><math>13 \times 4 = 52</math></b>	<b>80</b>

**Physics I**  
(AG1104SH)

**Year: I**  
**Semester: I**

**Total: 7 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: 1 hour/week**  
**Practical: hours/week**  
**Lab: 2 hours/week**

**Course description**

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

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

**Course objectives**

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

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

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

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

**Minimum Standards:**

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

**Methodology of teaching:**

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

**Evaluation methods:**

Written and viva exams performance observation.

## Course Contents:

### Theory I

- Unit 1. Mechanics: 30 Hrs.**
- 1.1 Units and measurement: 3 Hrs.**
- Units and Measurement of physical quantities.
  - Fundamental units and instrument use to measure these quantities and derive units.
  - Explain the physical concept of mass, length and time with relating them to various derive unit.
  - Precision and accuracy of measurement.
  - Various systems of units and their conversion.
  - Express derived units in terms of fundamental units.
  - Dimensional formula for various physical quantities.
  - Application of dimensional equation.
- 1.2 Scalar and vectors: 2 Hrs.**
- Scalar and vectors with examples.
  - Vectors addition by parallelogram and triangle method.
  - Resolve a vector into two components.
  - The product of two vectors either results in a scalar quantity or a vector quantity.
  - Simple numerical problems.
- 1.3. Kinematics: 4 Hrs.**
- Displacement, velocity, instantaneous velocity, average and uniform velocity and acceleration (retardation).
  - Distance and displacement, speed and velocity.
  - Kinematics equation of motion (linear and gravitational).
  - The concept of projectile motion.
  - simple numerical problems.
- 1.4. Force: 7 Hrs.**
- Newton's laws of motions and their significance with examples.
  - Law of Principle of conservation of linear momentum.
  - Collision; introduction to Elastic and inelastic collision with example.
  - Angular displacement, velocity and acceleration.
  - Derivation of the relation  $v = \omega r$ .
  - Vector nature of velocity and change of the direction of velocity in circular motion.
  - The magnitude of centripetal force and centrifugal force,  $F = mv^2/r = m\omega^2 r$
  - Friction, limiting friction, angle of friction and coefficient of friction.
  - Law of limiting friction.
  - The relation between angle of fraction and coefficient of fraction.
  - Simple numerical problems.
- 1.5. Work, energy, and power: 2 Hrs.**
- Definition and units of work, energy and power.
  - Potential and kinetic energy.
  - Conservative force.

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

- 1.6. Gravity and Gravitation: 3 Hrs.**
- Laws of gravitation;  $F = GMm/R^2$ .
  - Acceleration due to gravity, mass and weight.
  - Derive  $g = GM/R^2$ ; the relation between gravitation constant and acceleration due to gravity.
  - The variation of  $g$  due to height and depth.
  - Center of mass and center of gravity.
  - Constitutions of equilibrium of a body with examples.
  - Formula of escape velocity (No derivation).
  - Simple numerical problems.
- 1.7. Rotational dynamics of rigid bodies: 2 Hrs.**
- Forces in equilibrium, torque, couple, C.G. and center of mass.
  - Moment of inertia.
  - Angular momentum and Its conservation with example.
  - Work done by torque.
  - Simple numerical problems.
- 1.8. Hydrostatics: 3 Hrs.**
- Fluid pressure and determination of the formula  $P = \rho gh$ .
  - Pascal's law.
  - Density and specific gravity.
  - Difference between density and specific gravity.
  - Working principle of pumps; rotatory pump and lift pump.
  - Archimedes' s principle and its uses.
  - The Principle of flotation and condition of equilibrium for floating bodies.
  - Atmospheric pressure with examples.
- 1.9 Properties of matter: 4 Hrs.**
- Definition of elasticity.
  - Statement of Hook's law of elasticity.
  - Definition of stress, strain and Young's modulus of elasticity.
  - Definition of viscosity.
  - Statement of Newton's formula of viscosity.
  - Definition of coefficient of viscosity.
  - Derivation of unit and dimension of viscosity.
  - Definition of terminal velocity.
  - Definition of Adhesive force and cohesive force.
  - Definition and explain surface tension.
  - Capillary action with example (no derivation)
  - Solve related numerical problems.
- Unit 2. Wave and sound: 4 Hrs.**
- 2.1. Wave motion:**
- Definition of damped vibration, forced vibration and resonance.
  - Definition of longitudinal wave, progressive wave and stationary wave.

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

**Unit 3. Light: 20 Hrs.**

**3.1. Reflection of light: 4 Hrs.**

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

**3.2. Refraction of light: 7 Hrs.**

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

**3.3. Optical instrument: 6 Hrs.**

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

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

**3.4. Wave theory of light: 3 Hrs.**

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

**Unit 4. Electrostatics: 6 Hrs.**

**4.1. Electrostatics Field:**

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

**Physics Practical I (Laboratory) 30 Hrs.**

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

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

**Recommended text:**

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

**Reference Texts:**

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

Note: In case of an unavailability of above sources;

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

**Final written exam marking scheme**

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

**Chemistry I**  
(AG1105SH)

**Year: I**  
**Semester: I**

**Total: 7 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: 1 hour/week**  
**Practical: hours/week**  
**Lab: 2 hours/week**

**Course description:**

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

**Course objectives:**

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

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

**Course Contents:**

**Theory**

**Unit: 1: General Chemistry:**

**7 Hrs.**

**1.1.Symbol:**

- Definition
- Significance (qualitative and quantitative)

**1.2.Formula:**

- Definition
- Significance (qualitative and quantitative)
- Concept of valency in terms of combining capacity with H<sub>2</sub>, O<sub>2</sub>, and Cl<sub>2</sub>
- Variable valency (ref. Fe, Sn, Pb, Cu, Hg, S and N)
- Radicals (electro- positive and electro - negative)
- Writing a formula

**1.3.Chemical equation:**

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

## **Unit: 2: System of Classification:**

**20 Hrs.**

### **2.1. Atomic structure:**

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

### **2.2. Electronic theory of valency:**

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

### **2.3. Oxidation and reduction:**

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

### **2.4. Periodic table:**

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

### **2.5. Acid, Base and Salt:**

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

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

#### **2.6.States of matter-Gaseous state**

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

#### **2.7.States of matter-Liquid State**

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

#### **2.8.States of matter-Solid State**

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

#### **2.9.Solutions-True solution**

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

#### **2.10. Mole concept and chemical arithmetic**

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

#### **2.11. Environmental Chemistry**

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

### **Organic chemistry**

**18 Hrs.**

#### **3.1: An introduction to organic Chemistry**

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

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

### 3.2: Nomenclature of organic compounds

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

### 3.3: Isomerism

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

### 3.4: Organic reaction

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

### 3.5: Hydrocarbons

#### A. Alkane

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

#### B. Alkene

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

- The chemical properties-Combustion, halogenation, with Br<sub>2</sub> solution, with halogen acid (Test of double bond), with Baeyer's reagent, polymerization, ozonolysis
- Markovnikov's rule

### C. Alkyne

- Laboratory preparation of ethyne from calcium carbide.
- Physical properties of acetylene
- Chemical properties-Combustion, hydrogenation, catalytic hydration, with Br<sub>2</sub> solution, with Na, with tollens reagent, with Bayer's; reagent, ozonolysis polymerization, with Cl<sub>2</sub>
- Markovnikov's rule.
- Uses of ethyne in life

### 3.6 Alkyl halides

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

### 3.7: Alcohol

- Classification of alcohol as- monohydric, dihydric, polyhydric, primary, secondary and tertiary
- Identification of primary, secondary and tertiary alcohol by oxidation method
- Physical properties of ethanol
- Chemical properties- Oxidation, with sodium, with oxygen, with H<sub>2</sub>SO<sub>4</sub>, CH<sub>3</sub>COCl, CH<sub>3</sub>COOH, combustion

### Practical (Laboratory)

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

9. To determine the equivalent weight of reactive metal by hydrogen displacement method. 2 Hrs.
10. To prepare and study the properties of hydrogen gas 2 Hrs.
11. To prepare and study the properties of ammonia gas 2 Hrs.
12. To detect the acid radicals ( $\text{Cl}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{CO}_3^{2-}$ ) by dry and wet ways 4Hrs.

**Textbooks:**

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

**References:**

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

**Other learning materials:**

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

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

**Final written exam marking scheme**

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

**Zoology I**  
(AG1106SH)

**Year: I**  
**Semester: I**

**Total: 6 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: hour/week**  
**Practical: hours/week**  
**Lab: 2 hours/week**

**Course description:**

This basic course in zoology discusses the characteristics of unicellular and multicellular structures. The course contains introductory zoology, cell biology, the study of different types of tissues, animal diversity, evolution of organisms, anatomy and physiology of earthworm and economically important insects.

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

**Course objectives:**

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

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

**Course Contents:**

**Theory [60 Hours]**

<b>Unit 1. Introduction to Zoology</b>	<b>2 Hrs.</b>
1.1. Definition, scope and branches of Zoology	
1.2. Meaning of zoology, Scope of zoology, link with physics, chemistry and other sciences	
1.3. Different branches of zoology: Morphology, anatomy, physiology, cytology, Histology, embryology, Hepatology, Herpetology, parasitology, entomology, Helminthology, proto-zoology, Bacteriology, virology, paleontology, ecology, genetics, toxicology	
1.4. Introduction to Preservation Techniques	
1.4.1 Definition and importance of preservation	
1.4.2 Types of common preservation techniques- Wet and Dry methods	
1.4.3 Protocol of following preservation techniques:	

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

1.4.5 Taxidermy

## **Unit 2. Cell Biology**

**14 Hrs.**

### 2.1. Introduction to Cell

2.1.1. Basic structure of prokaryotic and eukaryotic cell

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

2.1.3. Meaning of Cyclosis, endocytosis, exocytosis

### 2.2. Cell Division

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

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

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

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

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

### 2.3. Tissues and their types

2.3.1. Definition of tissue and describe its types.

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

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

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

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

2.3.6. Flow chart of types of tissues and its subtypes

## **Unit 3 Diversity of Animal Life**

**11 Hrs.**

### 3.1. Concept of Taxonomy

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

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

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

3.1.4. Basis of classification in different systems

3.1.5. Differences between artificial and natural systems of classification

### 3.2. Binomial Nomenclature and Classification

3.2.1. Describe the need for scientific nomenclature

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

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

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

**Unit 4 Animal phylogeny and classification** **12 Hrs.**

- 4.1. General characteristics and classification of different phyla of animals.
  - 4.1.1 General characters of phylum Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Chordata.
  - 4.1.2 List the classes of each phylum and two common examples of each.

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

- 5.1. Describe origin of life and its theories: Oparin and Haldane theory; Miller-Urey experiment
- 5.2. Define evolution and organic evolution
- 5.3. Evidences of organic evolution: morphological, anatomical, paleontological, biochemical, genetic and embryological.
- 5.4. Describe different theories of organic evolution-
  - 5.4..1. Lamarck Theory of organic evolution, example and limitations of the theory
  - 5.4..2. Darwinism/ Theory of Natural selection and Neo Darwinism/ modern Synthetic theory with example and drawbacks of Darwinism
- 5.5. Geological time period and evolutionary tree of humans
- 5.6. Describe different stages of evolution of Man and highlight the key features: Proconsul; Dryopithecus; Ramapithecus; Shivapithecus; Australopithecus; Modern human ancestors such as Homo habilis; Homo erectus; Java man (Homo erectus or pithecanthropus erectus); Peking man (Homo erectus pekinensis or Sinanthropus pekinensis); Neanderthal man (Homo sapiens neanderthalensis); Cro-Magnon man; Modern man

**Unit 6 Study of Earthworm** **5 Hrs.**

- 1.1. Systematic position habit, habitat, external features.
- 1.2. Structure, organs and physiology of digestive system, reproductive system, and nervous system
- 1.3. Economic importance of earthworm.

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

- 7.1. Systemic position, habit and habitat, morphological structure, life cycle and economic importance of
  - 7.1.1 Honeybee and
  - 7.1.2 Silkworm.

**Practical [30 Hrs.]**

**Unit 1 Use of the microscope** **4 Hrs.**

- 1.1. Description of importance of microscope, it's types, parts of microscope & functions of its different parts, observation techniques.
- 1.2. Proper handling of microscope.
- 1.3. Explain the concept of magnification.

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

- 2.1. Study of permanent slides and museum specimens (Invertebrata-Paramecium, Amoeba, Plasmodium & its lifecycle; Sycon; Hydra; Tapeworm and its life cycle; Round worm & its life cycle; Liver fluke; Earthworm; Leech; common arthropoda specimens; Snail; Starfish. Chordata- Rohu, Flying fish; frog, tree frog; lizard; snake; Pigeon; Parrot; Rat; Squirrel
- 2.2. Identification of common insects, other animals in agricultural ecosystem
- 2.3. Identification of common birds in agricultural ecosystem

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

- 2.1. Microscopic observation of permanent slides of animal tissues
- 2.2. Preparation of temporary slide of cheek and its study

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

- 4.1. Dissection of earthworm
- 4.2. Temporary mount of setae of earthworm

**Final written exam marking scheme**

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

**Botany I**  
(AG1107SH)

**Year: I**  
**Semester: I**

**Total: 6 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: hour/week**  
**Practical: hours/week**  
**Lab: 2 hours/week**

**Course description:**

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

**Course objectives:**

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

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

**Course Contents:**

**Theory**

<b>Unit 1. Introduction to botany:</b>	<b>3 Hrs.</b>
1.1. Definition and Scope of Botany	
1.2. Importance of Botany	
1.3. Branches of Botany	
1.4. Discuss the relation of Botany with other sciences like Physics, Chemistry, Statistics etc.	
<b>Unit 2. Molecular Biology:</b>	<b>11 Hrs.</b>
2.1 Life Components	1 Hr.
• Define the terms cellular pool, biomolecules, micro molecules and macro molecules with examples.	
• List inorganic and organic molecules of the living system	
• Define monomers and polymers with examples.	
2.2 Water:	1Hr.
• Structure, properties and biological role of water.	
2.3 Carbohydrates:	2 Hrs.
• Define carbohydrates.	
• Define glycosidic bond.	
• Define monosaccharide, oligosaccharides, and polysaccharides with examples.	
• List functions of carbohydrates	
2.4 Proteins	2 Hrs.
• Define proteins as polypeptides.	
• Define essential and non-essential amino acids with examples.	
• Define peptide bonds.	
• Define primary, secondary and tertiary structure of protein.	
• Define denaturation and renaturation of proteins.	

	<ul style="list-style-type: none"> <li>List functions of proteins.</li> </ul>	
2.5	<p>Lipids</p> <ul style="list-style-type: none"> <li>Define lipids as triglycerides.</li> <li>Define saturated and unsaturated fatty acids.</li> <li>Differentiate fats and oils.</li> <li>Define phospholipids.</li> <li>List functions of Lipids.</li> </ul>	2 Hrs.
2.6	<p>Nucleic Acids:</p> <ul style="list-style-type: none"> <li>Define nucleic acids as polynucleotides.</li> <li>List components of Nucleotides.</li> <li>Define phosphodiester bond.</li> <li>Define and differentiate DNA and RNA.</li> <li>List function of Nucleic acids.</li> </ul>	3 Hrs.
<b>Unit 3. Taxonomy and Biodiversity:</b>		<b>41 Hrs.</b>
3.1	<p>Concepts of Taxonomy:</p> <ul style="list-style-type: none"> <li>Define plant taxonomy.</li> <li>Give importance of plant taxonomy.</li> <li>Identify taxonomic hierarchy and categories in plant classification with examples.</li> <li>Define binomial system of nomenclature.</li> </ul>	2 Hrs.
3.2	<p>System of classification</p> <ul style="list-style-type: none"> <li>Define artificial, natural and phylogenetic systems of classification with examples and their differences.</li> </ul>	2 Hrs.
3.3	<p>Concepts of Biodiversity:</p> <ul style="list-style-type: none"> <li>Define biodiversity.</li> <li>Discuss importance of conserving biodiversity.</li> <li>Give levels of biodiversity- ecosystem and habitat diversity, species diversity and genetic diversity.</li> <li>Give the latest status of biodiversity of Nepal.</li> <li>List protected plant species in Nepal.</li> <li>Define endemic species and list the endemic species of Nepal.</li> </ul>	4 Hrs.
3.4	<p>Virus:</p> <ul style="list-style-type: none"> <li>Define virus.</li> <li>Give general characteristics of virus.</li> <li>Give classification of virus on the basis of host and genetic material.</li> <li>Give structure of a Bacteriophage.</li> <li>Summarize the process of viral replication.</li> <li>Describe the mode of transmission of virus.</li> <li>List some viral diseases in plants.</li> <li>Describe the economic importance of virus</li> </ul>	4 Hrs.
3.5	<p>Bacteria and Cyanobacteria</p> <ul style="list-style-type: none"> <li>Define bacteria and give general characteristics of bacteria.</li> <li>Give classification of bacteria based on shape, Gram staining and mode of nutrition.</li> <li>Describe the economic importance of bacteria.</li> </ul>	4 Hrs.

	<ul style="list-style-type: none"> <li>Define cyanobacteria and give general characteristics of cyanobacteria with example.</li> <li>Describe the economic importance of cyanobacteria.</li> </ul>	
3.6	Fungi	4 Hrs.
	<ul style="list-style-type: none"> <li>Define fungi.</li> <li>Give general characteristics of fungi.</li> <li>Outline the classification of fungi.</li> <li>Describe life cycle of Yeast with labeled diagram.</li> <li>Describe economic importance of Fungi.</li> </ul>	
3.7	Algae	4 Hrs.
	<ul style="list-style-type: none"> <li>Define Algae.</li> <li>List general characteristics of Algae.</li> <li>Give three major classes of Algae- Chlorophyceae, Phaeophyceae and Rhodophyceae with their chief distinguishing features.</li> <li>Describe structure, reproduction and life cycle of Spirogyra.</li> <li>Describe economic importance of Algae.</li> </ul>	
3.8	Bryophytes	3 Hrs.
	<ul style="list-style-type: none"> <li>Define Bryophyta.</li> <li>Give general characteristics of Bryophyta.</li> <li>Classify Bryophytes as liverworts, hornworts and mosses.</li> <li>List economic importance of Bryophyta.</li> <li>Give structure, reproduction types of Marchantia.</li> </ul>	
3.9	Pteridophytes	3 Hrs.
	<ul style="list-style-type: none"> <li>Define Pteridophyta.</li> <li>Give general characteristics of Pteridophyta.</li> <li>Describe the types of reproduction found in pteridophytes.</li> <li>Give economic importance of Pteridophytes.</li> </ul>	
3.10	Gymnosperm	3 Hrs.
	<ul style="list-style-type: none"> <li>Define Gymnosperms.</li> <li>Give general characteristics of Gymnosperms.</li> <li>List major groups of living Gymnosperms with examples of representative species.</li> <li>Give economic importance of Gymnosperms.</li> </ul>	
3.11	Angiosperm	2 Hrs.
	<ul style="list-style-type: none"> <li>Define Angiosperms.</li> <li>Give general characteristics of Angiosperms.</li> <li>List differences between dicotyledons and monocotyledons.</li> </ul>	
3.12	Morphology of Angiosperm	4 Hrs.
	<ul style="list-style-type: none"> <li>Description of angiospermic plants in semi technical terminologies. habit; general types, parts, features, modifications of root, stem, Leaf, inflorescence, flower and fruits.</li> </ul>	
3.13	Study of some Angiosperm families	5 Hrs.
	<ul style="list-style-type: none"> <li>Discuss the characteristic features of some common Angiosperm families with examples and economic importance:</li> <li>Poaceae, Cruciferae, Solanaceae, Fabaceae.</li> </ul>	
	<b>Unit 4. Economic Botany:</b>	<b>5 Hrs.</b>
4.1	Food Plants:	2 Hrs.

- List some important food plants of Nepal and their parts used as food value. (Cereals, Pulses, Vegetables, Fruits)
- 4.2. Medicinal Plant: 2 Hrs.
- List some important medicinal plants of Nepal and their parts used.
- 4.3. Concepts of Ethnobotany 1 Hr.
- Define the term 'ethnobotany'.
  - Discuss the value and importance of traditional knowledge.

**Practical (Laboratory) 30 Hrs.**

### **Practical 1: Molecular Biology**

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

### **Practical 2: Taxonomy and Biodiversity**

#### **Monera:**

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

#### **Fungi:**

- Study yeast cells and their budding under compound microscope.

#### **Plantae:**

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

#### **Taxonomy of Angiosperms:**

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

#### **Recommended Textbooks:**

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

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

**Learning materials:**

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

**Final written exam marking scheme**

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

**First Year/Second Semester**

**English II**  
**1201 SH**

**Year: I**  
**Semester: II**

**Total: 4 hours /week**  
**Lecture: 4 hour/week**  
**Practical: hours/week**

**Course Description:**

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

**Course Objectives:**

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

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

**Section One: Language Development**

**40 Hrs.**

**Unit 1: Technology**

**4 Hrs.**

- 1.1 Reading comprehension: Hyper loop
  - 1.1.1 Use of technological terms
  - 1.1.2 Use of prefixes
  - 1.1.3 Question- answer
- 1.2 Issuing a press release
- 1.3 Subject Verb agreement
- 1.4 Summarizing
- 1.5 Project Work

**Unit 2: Money and Economy**

**4 Hrs.**

- 2.1 Reading comprehension: QR Code
  - 2.1.1 Use of terminologies
  - 2.1.2 Abbreviations
  - 2.1.3 Vowel sounds
  - 2.1.4 Question- Answer
- 2.2 Writing a news article
- 2.3 Questions:
  - 2.3.1 Yes/no questions
  - 2.3.2 Wh - questions
  - 2.3.3 Indirect and direct questions
- 2.4 Expressing necessity
- 2.5 Project Work

**Unit 3: Human Culture**

**4 Hrs.**

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

- 3.2 Writing:
  - 3.2.1 Paragraph
  - 3.2.2 Letter to the editor
- 3.3 Adjectives and Adverbs
- 3.4 Making comparison and contrast
- 3.5 Project Work

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

- 4.1 Reading Comprehension: Living in a Redwood Tree
  - 4.1.1 Terminologies used in ecology
  - 4.1.2 Compound words
  - 4.1.3 Question - answer
- 4.2 Writing a book/film review
- 4.3 Reported Speech
- 4.4 Reporting
- 4.5 Project Work

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

- 5.1 Reading Comprehension: Presenting Yourself
  - 5.1.1 Employment-related terminologies
  - 5.1.2 Answering questions
- 5.2 Writing job application with CV
- 5.3 Conditional Sentences
- 5.4 Clarifying
- 5.5 Project Work

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

- 6.1 Reading Comprehension: "I am Sorry"- The Hardest Three Words to Say
  - 6.1.1 Word formation
  - 6.1.2 Question-answer
- 6.2 Writing Paragraphs on Steps on making education equal
- 6.3 Connectives
- 6.4 Group work: Criticizing
- 6.5 Project Work

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

- 7.1 Reading comprehension: Train to Pakistan
  - 7.1.1 Terminologies
  - 7.1.2 Question -answer
  - 7.1.3 Vowels: Monophthongs and diphthongs
- 7.2 Describing People, place or event
- 7.3 Past simple, Past continuous, Past perfect, Past perfect continuous tense
- 7.4 Group work: Making Announcements
- 7.5 Project Work

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

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

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

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

- 9.1 Reading Comprehension: Dediasporization: Homeland and Hostland
  - 9.1.1 Consonants: Voiced and voiceless sounds
  - 9.1.2 Stressed and unstressed syllable
  - 9.1.3 Question - answer
- 9.2 Interpreting data in charts and graphs
- 9.3 Would/ Used to
- 9.4 Narrating past events
- 9.5 Project Work

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

- 10.1 Reading Comprehension: An Open Letter to Mary Daly
  - 10.1.1 Terminologies used in politics
  - 10.1.2 Consonant cluster
  - 10.1.3 Question- answer
- 10.2 Writing an article for a newspaper
- 10.3 Adjective order
- 10.4 Pair work: Denying
- 10.5 Project Work

**Section Two: Literature** **20 Hrs.**

**Unit One: Short Stories**

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

**Unit Two: Poems**

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

**Unit Three: Essays**

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

**References:**

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

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

### Evaluation Scheme

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

## Mathematics II

(1202SH)

**Year: I**  
**Semester: II**

**Total: 6 hours /week**  
**Lecture: 5 hours/week**  
**Tutorial: 1 hour/week**  
**Practical: hours/week**  
**Lab: hours/week**

### Course description:

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

### Course objectives:

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

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

### Course Contents:

#### Unit: 1: Vectors

**15 Hrs.**

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

#### Unit: 2: Algebra

**20 Hrs.**

- 2.1. Permutation and combination
- 2.2. Binomial theorem, Exponential and logarithmic series
- 2.3. Complex numbers:
  - Conjugate and its properties
  - Modulus and its properties
  - Polar form
  - De moivre's theorem and its application
  - Cube roots of unity and its properties
- 2.4 Matrices and Determinants:
  - Algebra of matrices
  - Properties of determinant
  - Solution of linear equation using cramer's rule
  - Row equivalent matrix method

#### Unit: 3: Geometry

**15 Hrs.**

- 3.1 The parabola:

- Standard equations
  - Tangent and normal
- 3.2 Co-ordinates in space  
3.3 Co-ordinates in plane

**Unit: 4: Calculus**

**15 Hrs.**

4.1 Applications of derivative:

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

4.2 Applications of anti-derivative:

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

**Unit: 5: Statistics and Probability**

**10 Hrs.**

5.1 Statistics

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

5.2 Probability:

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

**Recommended textbooks:**

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

**Evaluation Scheme**

**Unit wise Marks division for Final Exam**

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

**Physics II**  
(AG1203SH)

**Year: I**  
**Semester: II**

**Total: 7 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: 1 hour/week**  
**Practical: hours/week**  
**Lab: 2 hours/week**

**Course description**

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

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

**Course objectives**

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

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

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

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

**Minimum Standards:**

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

**Methodology of teaching:**

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

**Evaluation methods:**

Written and viva exams performance observation.

## Course Contents:

### Theory

<b>Unit 1. Current Electricity:</b>	<b>14 Hrs.</b>
1.1 Electric Current:	3 Hrs.
<ul style="list-style-type: none"><li>• Current as the rate of flow charge.</li><li>• Potential difference.</li><li>• Ohm's law and its verification.</li><li>• Expression <math>R=R_1+R_2+R_3+\dots</math> and <math>1/R=1/R_1+1/R_2+1/R_3+\dots</math> in series and parallel combination.</li><li>• Conversion of a galvanometer into ammeter and voltmeter.</li><li>• Ohmic and non-Ohmic conductors from I-V curve.</li><li>• Wheat stone bridge and its principle; balance condition. (Using concept of p.d. equal in balanced state).</li><li>• Application of wheat stone bridge.</li><li>• Conversion of galvanometer into voltmeter and ammeter.</li><li>• Simple numerical problems.</li></ul>	
1.2 Resistance and heat:	3 Hrs.
<ul style="list-style-type: none"><li>• Joule's laws of heating and derivation of the equation <math>H=i^2Rt/J</math>.</li><li>• Heat production in resistance wire due to passage of current.</li><li>• Electric power in terms of energy dissipated in a time in the resistance wire.</li><li>• Meaning of e.m.f and internal resistance of a cell relation <math>E=V+Ir</math>.</li><li>• Electric power, watt, kilowatt, kilowatt-hour and horsepower.</li><li>• Meaning of joule's conversion factor - joule's constant.</li><li>• Simple numerical problems.</li></ul>	
1.3. Electromagnetism:	4 Hrs.
<ul style="list-style-type: none"><li>• Explanation of Oersted's discovery, direction of current and field.</li><li>• Dependence of force on physical factors.</li><li>• Find force on moving charge.</li><li>• Motion of Moving charge in magnetic field in perpendicular direction.</li><li>• Statement of principle of moving coil galvanometer.</li><li>• Definition of electromagnetic induction.</li><li>• Statement of Faraday's laws of electromagnetic induction.</li><li>• Statement of Lenz's law.</li><li>• Principle and working of a.c. generator.</li><li>• Solve related numerical problems.</li></ul>	
1.4. Alternating Current:	4 Hrs.
<ul style="list-style-type: none"><li>• AC and DC importance of AC over DC.</li><li>• Expression <math>i_{rms}</math>, <math>v_{rms}</math> and <math>i_{mean}</math>, <math>v_{mean}</math> with peak value.</li><li>• Reactance and impedance for different a.c Circuit. (No derivation).</li><li>• Resonance in A.c Circuit (Condition).</li><li>• Working of a transformer and energy loss mechanisms in transformers.</li><li>• Simple numerical problems.</li></ul>	
<b>Unit 2. Magnetism:</b>	<b>8 Hrs.</b>
2.1 Fundamentals of Magnetism:	
<ul style="list-style-type: none"><li>• Magnet and its properties.</li></ul>	

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

**Unit 3. Heat: 18 Hrs.**

- 3.1. Thermometry: 2 Hrs.
- Concept of heat and temperature.
  - Explain sensitivity of a liquid thermometer.
  - Demonstrate various types of thermometers and explain their uses.
  - Derivation of the formula:  $C/5 = (F-32)/9 = (K-273)/5$ .
  - Relation between different temperature scales.
  - Simple numerical problems.
- 3.2. Thermal Expansion: 3 Hrs.
- Linear, superficial and cubical expansion of solids.
  - The relations  $l_2 = l_1 [1 + \alpha (\theta_2 - \theta_1)]$ ,  $A_2 = A_1 [1 + \beta (\theta_2 - \theta_1)]$ ,  $V_2 = V_1 [1 + \gamma (\theta_2 - \theta_1)]$ .
  - Relation between coefficient of linear, superficial and cubical expansion of solids.
  - Apparent and real expansion of a liquid.
  - Change in density of an object due to change in temperature.
  - Anomalous expansion of water and its importance to marine life.
  - Use of water cooling and heating purposes.
- 3.3. Heat Capacity: 3 Hrs.
- Heat capacity, specific heat capacity.
  - The relation between joule and calorie.
  - Melting point, boiling point and freezing point of a substance.
  - The effect of pressure on melting and boiling point of substance.
  - Calorimetric principle.
  - Latent heat of vaporization and fusion.
  - Determination of latent heat of fusion of ice by the method of mixture.
  - Simple numerical problems.
- 3.4. Hygrometry: 2 Hrs.
- Definition of saturated and unsaturated vapors.
  - Definition of triple point; triple point of water.

- Definition of dew point, absolute humidity and relative humidity.
  - Explanation of dryness and dampness.
  - Determination of relative humidity by wet and dry bulb hygrometer.
  - Description of Air conditioning.
  - Solve related numerical problems.
- 3.5. Transfer of heat 2 Hrs.
- The transfer of heat by conduction, convection and radiation.
  - Thermal conductivity giving its dimension and units.
  - Laws of black body radiation.
  - Solve related numerical problems.
- 3.6. Gases: 6 Hrs.
- Statement of Boyle's law and Charle's law.
  - Definition of absolute temperature and absolute Zero.
  - Concept of ideal gas equation.
  - Know the value of R.
  - To state and explain Dalton's law of partial pressure.
  - Derivation general formula of work done by gas.
  - Definition of internal energy of gas.
  - Statement of first law of thermodynamics and its draw backs.
  - Definition of Molar and specific heat capacity of a gas.
  - Derivation of  $C_p - C_v = R$
  - Definition of isothermal and adiabatic changes.
  - Derivation of pressure exerted by a gas.
  - Explanation for r.m.s. speed.
  - Solve related numerical problems.
- Unit 4. Modern Physics:** **20 Hrs.**
- 4.1. Electrons: 3 Hrs.
- Practical nature of electricity.
  - Production and properties of cathode rays.
  - Moving electrons in electric and magnetic fields.
  - Specific charge of an electron.
- 4.2. Photo electricity: 4 Hrs.
- Photoelectric effect, quantum theory of radiation.
  - Einstein's photoelectric equation  $h\nu = \phi + \frac{1}{2}mv^2$  and interpretation.
  - Explanation of postulates of Bohr's theory of hydrogen atom.
  - Wave nature of particle.
  - Simple numerical problems.
- 4.3. X-rays: 2 Hrs.
- X-rays and its Properties of x-rays.
  - Production and nature of x-rays.
  - Various uses of x-rays. (hard and soft).
  - Continuous and characteristic X-rays.
  - Simple numerical problems.

- 4.4. Radioactivity: 4 Hrs.
- Radioactivity.
  - Properties of  $\alpha$ ,  $\beta$  and  $\gamma$  radiations.
  - Laws of radioactive disintegration. ( $N=N_0 e^{-\lambda t}$ ,  $dN/dt = -\lambda t$ )
  - The constant relationship between half-life and decay.
  - Concept of carbon dating.
  - Agricultural uses of radiation and artificial radioactive nuclei.
  - Simple numerical problems.
- 4.5. Properties of nucleus: 4 Hrs.
- The constitutions of nuclei.
  - mass numbers of different elements and Isotopes, isobars.
  - Atomic mass unit and Binding energy, Mass defect and B.E of nucleus.
  - Einstein's mass energy relation.
  - Fission and Fusion with energy released estimation.
  - Radiation hazard and safety.
- 4.6. Physics and society: 3 Hrs.
- Deteriorating conditions of the environment we live in.
  - Concepts of different types of pollution. (with cause and effect).
  - Concepts about ozone depletion, greenhouse effect and acid rain.
  - Useful and harmful aspects of radiation.
  - Environmental protection strategies.

**Physics Practical II (Laboratory) 30 Hrs.**

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

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

**Recommended text:**

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

**Reference Texts:**

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

**Note:** in case of an unavailability of above sources;

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

**Final written exam marking scheme**

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

**Chemistry II**  
(AG1204SH)

**Year: I**  
**Semester: II**

**Total: 7 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: 1 hour/week**  
**Practical: hours/week**  
**Lab: 2 hours/week**

**Course description:**

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

**Course objectives:**

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

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

**Course Contents:**

**Theory**

**Unit 1 Physical Chemistry**

**7 Hrs.**

1.1: Electrochemistry

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

1.2: Volumetric analysis

- Equivalent and gram equivalent weight of element, acid, base, and salt
- Titration, acidimetry, alkalimetry, end point, indicator, primary standard substance
- Ways of expressing concentration of solution in terms of
  - i) Normality
  - ii) Molarity
  - iii) Molality and %.

- Normality equations
- Calculations to prepare different concentrations of solution

## Unit: 2 Inorganic Chemistry

18 Hrs.

### 2.1: Water

- Soft and hard water
- The process of removal of hardness: -Boiling, Clark's process using washing soda, permutit process, soda-ash method, deionization of water
- The advantages and disadvantages of hard water
- The meaning of drinking water
- Methods of purification of drinking water by boiling, candle filtration, chemical disinfection, bleaching powder,  $\text{Cl}_2$  solution, iodine,  $\text{KMnO}_4$  ozonisation, using potash alum
- The solvent property of water

### 2.2.: Non-metals

- Hydrogen- physical properties, reaction with  $\text{O}_2$ , Na, Ca,  $\text{X}_2$ ,  $\text{N}_2$ , vegetable oil, uses, heavy water, isotopes of hydrogen.
- Oxygen-physical properties, reaction with C, Ag, Na,  $\text{H}_2$ ,  $\text{SO}_2$ ,  $\text{NH}_3$ ,  $\text{N}_2$ , uses.
- Carbondioxide: physical properties, reaction with Na, Mg,  $\text{H}_2\text{O}$ , lime water, carbon, iron, and uses.
- Ammonia: manufacture by haber's process. (principle with diagrammatic sketch.)
- Physical properties, chemical properties with  $\text{H}_2\text{O}$ ,  $\text{O}_2$ , Na, AgCl,  $\text{CuSO}_4$ , nessler's reagent and uses.
  - General characteristics of halogens

### 2.3: Acids and chemical fertilizers

- Nitric Acid: Ostwald process. (principle with diagrammatic sketch.)
- Physical properties, acidic character, action with carbon, Sulphur,  $\text{H}_2\text{S}$ ,  $\text{SO}_2$ .
- Action with  $\text{FeSO}_4$ , Mg, Zn, copper, ring test.
- Nitrogen cycle and causes of acid rain
- NPK fertilizer, characteristics, natural and artificial fertilizer, examples and need of NPK fertilizers.
- Role of Fertilizers in plant or vegetation
- Advantage and disadvantage of chemical fertilizer.
- Pesticide insecticide, rodenticide herbicide, fungicide and their examples.
- Sulphuric acid: contact process (no description)
- Physical properties, dehydrating action with Zn, Cu, salts, oxidising agents.
- Hydrochloric acid: physical properties, acidic nature, action with ammonia, silver nitrate, salts and uses.

### 2.4: Minerals

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

### 2.5: Cycles and Elements

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

## 2.6: Metals

- Characteristic of metals and non-metals
- Occurrence of metals.
- General metallurgy of metals. (crushing and dressing)
- Calcination and roasting, reduction with carbon.
- Purification (distillation and electro refining)
- Sodium: physical properties, action with air, water, non-metals  $\text{NH}_3$ .
- Physical properties of copper, action with  $\text{H}_2\text{SO}_4$ ,  $\text{HNO}_3$ , and short notes on bluevitrol.
- Zinc, physical properties, action with  $\text{HCl}$ ,  $\text{HNO}_3$ ,  $\text{H}_2\text{SO}_4$ , water, air and alkali, galvanization.
- Iron: physical properties action with  $\text{HCl}$ ,  $\text{HNO}_3$ ,  $\text{H}_2\text{SO}_4$ , water, halogen, rusting.

## Unit: 3: Organic Chemistry

20 Hrs.

### 3.1: Ether

- Lab preparation of diethylether from ethanol
- Physical properties
- Chemical Properties with Combustion, hydrolysis, reaction with  $\text{HI}$  and  $\text{PCl}_5$
- Uses in medicine and everyday life

### 3.2: Carbonyl compound

#### Lesson A Formaldehyde & Acetaldehyde

- General methods of preparation
- Physical properties.
- Chemical properties-with ammonia, with  $\text{NH}_4\text{OH}$ ,  $\text{NaOH}$ , Polymerisation.
- Uses in everyday life.

#### Lesson B. Acetone (Ketone)

- Preparation from isopropyl alcohol and Ca-acetate
- Physical properties
- Chemical properties with  $\text{NaHSO}_3$ , Phenyl hydrazine
- Uses in everyday life

### 3.3: Carboxylic acid Acetic Acid

- Preparation from acetylene and ethanol
- Physical properties
- Chemical properties with- $\text{NaHSO}_3$ ,  $\text{NH}_3$ ,  $\text{C}_2\text{H}_5\text{OH}$ ,  $\text{PCl}_5$  and reduction, acidity of carboxylic acid
- Uses in everyday life
- Uses of formic acid in everyday life
- Natural sources of acetic acid

### 3.4: Amines.

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

### 3.5: Phenol

- Preparation from benzene diazonium chloride and sodium benzene sulphonate, physical properties.

- Action with Na, Zn, NH<sub>3</sub>, benzene diazonium chloride Kolbe's reaction.

### 3.6: Aromatic Compounds

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

### 3.7: Natural Products chemistry

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

#### Practical (Laboratory)

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

#### Textbooks:

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

#### References:

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

#### Final written exam marking scheme

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

**Zoology II**  
(AG1205AS)

**Year: I**  
**Semester: II**

**Total: 6 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: hour/week**  
**Practical: hours/week**  
**Lab: 2 hours/week**

**Course description:**

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

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

**Course objectives:**

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

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

**Course Contents:**

**Theory 60 Hrs.**

**Unit 1 Study of life process of mammals**

**14 Hrs.**

- 1.1 Systemic position and morphology of man.
- 1.2 Structure, organs and physiology of
  - 1.2.1 Digestive system.
  - 1.2.2 Respiratory system.
  - 1.2.3 Circulatory system.
  - 1.2.4 Reproductive system and
  - 1.2.5 Excretory system
- 1.3 Introduction to Endocrine System- List different glands and its major role in human body
- 1.4 Nervous system- Basic structure and organs involved. Its major function in human body

## **Unit 2 Ecology and environment**

**23 Hrs.**

- 2.1 Ecosystem
  - 2.1.1 Structural and functional organization of ecosystems- Components of ecosystem, Abiotic and biotic factors of ecosystem and their interrelationships.
  - 2.1.2 Study the various components and its interactions in pond ecosystem and Grassland ecosystem as examples of Aquatic and Terrestrial ecosystems.
  - 2.1.3 Define Food chain, trophic level and describe energy flow in an ecosystem---
    - 2.1.3.1 Concept of ecological pyramid- its types
    - 2.1.3.2 Describe the interaction between biotic factors
      - 2.1.3.2.1 Positive interactions- commensalism, mutualism, colonization, and social organization
      - 2.1.3.2.2 Negative interactions- predation, parasitism, competition and antibiosis.
- 2.2 Ecological imbalances and consequences
  - 2.2.1 Greenhouse effect, acid rain and depletion of ozone layer
  - 2.2.2 Importance of Greenhouse effect and ozone layer for life on earth.
  - 2.2.3 Description of the mechanism of greenhouse effect, acid rain and depletion of the ozone layer.
  - 2.2.4 Causes and consequences of greenhouse effect, depletion of ozone layer, acid rain and biological invasion.
- 2.3 Environmental pollution
  - 2.3.1 Definition of pollution
  - 2.3.2 Types of pollution- Air, water, Land/ Soil, Radioactive Pollution
  - 2.3.3 Source of water pollution, their effect and preventive measures.
  - 2.3.4 Source of air pollution, their effect on living organisms and preventive measures of air pollution.
  - 2.3.5 Sources of soil pollution, their effects on living organisms and preventive measures of soil pollution
  - 2.3.6 Sources of Radioactive pollution, their effects on living organisms and preventive measures of Radioactive pollution

## **Unit 3 Animal adaptation**

**5 Hrs.**

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

## **Unit 4 Animal behavior**

**8 Hrs.**

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

## **Unit 5 Conservation of wildlife/ Conservation Biology**

**10 Hrs.**

Definition of wildlife/ State the concept of biodiversity

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

### **Practical**

#### **Unit 1 Dissection of animal**

**20 Hrs.**

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

#### **Unit 2 Study of an ecosystem**

**10 Hrs.**

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

### Recommended Text Books:

1. Ashok K Bam, Bidya Sagar Jha, Janak Raj Subedi, Rup Bahadur Shah, Dharendra Bahadur Jha- *Zoology for Agriculture with Practical*, Advance Ayam Publication.
2. Keshari Arvind- *A textbook of Zoology for health sciences*, Vidyarthi Pustak Bhandar
3. Shrestha Raghubar; Ghimire Suvas Chandra- *United Zoology for health sciences*, United Nepal Publications (P.) Ltd.
4. Kotpal, R. L., *Modern Text Book of Zoology, Invertebrates*, Rastogi Publications  
Kotpal R. L., *Modern Text Book of Zoology, Vertebrates*, Rastogi Publications -  
Keshari A., *Practical Biology*, Vidyarthi Publication.
5. Verma P. S., *Practical Zoology (Invertebrate)* – S Chand and Company Pvt. Ltd.
6. Verma P. S., *Practical Zoology (Chordate)*, S Chand and Company Pvt. Ltd.
7. Sharma Subodh- *A handbook of practical zoology*, Himalaya Book Stall.
8. Labh Shyam Narayan- *A Textbook of Practical Biology*, Taleju Prakashan.
9. Keshari Arvind, Khaga Raj Ghimire, Bijay Shankar Mishra- *Practical Biology for class XI*, Vidyarthi Pustak Bhandar.

### Reference Books:

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

### Final written exam marking scheme

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

**Botany II**  
(AG1206SH)

**Year: I**  
**Semester: II**

**Total: 6 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: hour/week**  
**Practical: hours/week**  
**Lab: 2 hours/week**

**Course description:**

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

**Course objectives:**

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

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

**Course Contents:**

**Theory**

**Unit 1: Plant Anatomy:**

**16 Hrs.**

1.1: Tissue and its types

8 Hrs.

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

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

6 Hrs.

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

- 1.3: Secondary growth 2 Hrs.
- Define secondary growth.
  - Discuss the role of cambium and cork cambium in the secondary growth of dicot root and stem.
  - Define annual rings and discuss how they are formed.

**Unit2: Plant Physiology 15 Hrs.**

2.1 Diffusion: 3 Hrs.

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

2.2. Osmosis: 3 Hrs.

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

2.3. Transpiration: 2 Hrs.

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

2.4 Photosynthesis 3 Hrs.

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

2.5: Respiration 4 Hrs.

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

**Unit 3: Embryology of Angiosperms 10 Hrs.**

3.1: Reproduction 3 Hrs.

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

3.2: Pollination 3 Hrs.

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

<ul style="list-style-type: none"> <li>List different types of pollination based on pollinating agent and features of flowers with such pollinations.</li> <li>Discuss merits and demerits of self and cross-pollination.</li> <li>Discuss mechanisms developed by flowering plants for cross-pollination.</li> </ul>	
3.3: Fertilization	3 Hrs.
<ul style="list-style-type: none"> <li>Define fertilization.</li> <li>Describe the structure of a typical angiosperm ovule with diagram.</li> <li>Describe the process of pollen germination, pollen tube development, double fertilization and triple fusion in angiosperms.</li> </ul>	
<b>Unit 4: Genetics</b>	<b>5 Hrs.</b>
4.1 Heredity and Variation	2 Hrs.
<ul style="list-style-type: none"> <li>Define heredity and variation.</li> <li>Explain causes of variation like environmental causes, mutation (gene and chromosomal), polyploidy etc.</li> <li>Define somatic and genetic variation, continuous and discontinuous variations.</li> <li>Describe the significance of variation.</li> <li>Define the terms: Chromosome, gene, alleles, genotype and phenotype, homozygous and heterozygous and clone.</li> </ul>	
4.2 Mendel's Law of Inheritance	3 Hrs.
<ul style="list-style-type: none"> <li>Explain Mendel's experiments.</li> <li>List the reasons for selecting pea plant by Mendel in his experiment.</li> <li>Define monohybrid and dihybrid crosses.</li> <li>Mendel's laws: Law of dominance, Law of Segregation, law of independent assortment.</li> </ul>	
<b>Unit 5: Biotechnology</b>	<b>8 Hrs.</b>
5.1: Introduction to Biotechnology	3 Hrs.
<ul style="list-style-type: none"> <li>Define Biotechnology.</li> <li>List the branches of Biotechnology.</li> <li>List the application of Biotechnology.</li> </ul>	
5.2: Plant Tissue Culture	3 Hrs.
<ul style="list-style-type: none"> <li>Define <i>in vitro</i> culture.</li> <li>Define cell, tissue, and organ culture.</li> <li>Define cellular totipotency.</li> <li>Define culture media.</li> <li>Tell importance of sterilization and list methods of sterilization.</li> <li>Define and summarize procedures of micropropagation and list its applications.</li> <li>List the applications of Plant Tissue Culture</li> </ul>	
5.3 Introduction to Plant Breeding	2 Hrs.
<ul style="list-style-type: none"> <li>Define plant breeding.</li> <li>List and define the methods of plant breeding (Hybridization).</li> <li>Discuss the significance of plant breeding.</li> </ul>	
<b>Unit 6: Environmental Biology</b>	<b>6 Hrs.</b>
6.1: Ecology	2 Hrs.

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

6.2: Ecological imbalance 4 Hrs.

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

**Practical (Laboratory) 30 Hrs.**

**Practical 1: Plant Breeding**

- Learn basic techniques and processes of hybridization experiments.

**Practical 2: Biotechnology**

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

**Practical 3: Plant Anatomy**

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

**Practical 4: Physiology**

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

**Practical 5: Embryology of Angiosperms**

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

**Learning materials:**

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

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

**Other learning materials:**

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

**Final written exam marking scheme**

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

## Computer Application

(EG1211CT)

**Year: I**  
**Semester: II**

**Total: 4 hours /week**  
**Lecture: 2 hours/week**  
**Tutorial: hour/week**  
**Practical: hours/week**  
**Lab: 2 hours/week**

### Course description:

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

### Course objectives:

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

1. Explain the basic architecture of Computer;
2. Identify major components of computer and their role;
3. Be familiar with the different Operating Systems like MS-DOS, Windows etc.;
4. Use the different Software applications;
5. Apply the basic networking concept; and
6. Apply internet for different purposes.

### Course Contents:

#### Theory

- |   |               |
|---|---------------|
| <b>Unit 1. Introduction to Computers:</b>                             | <b>2 Hrs.</b> |
| 1.1 History of computers  |               |
| 1.2 Generation of computer  |               |
| 1.3 Types of computer   |               |
| 1.4 Computer hardware and software                                    |               |
| <b>Unit 2. Hardware Components:</b>                                   | <b>6 Hrs.</b> |
| 2.1 Major blocks of a digital computer                                |               |
| 2.2 Input devices: keyboard, mouse, joystick, scanner, light pen etc. |               |
| 2.3 Output devices: monitor, printer, plotter, speaker etc.           |               |
| 2.4 Central Processing Unit   |               |
| 2.5 Memory Unit   |               |
| 2.5.1 Primary Memory (RAM and ROM)                                    |               |
| 2.5.2 Secondary Memory  |               |
| • Magnetic storage like floppy disk, hard disk, magnetic tape etc.    |               |
| • Optical storage like CD, DVD etc                                    |               |
| • Solid state storage like Pen drive, flash memory card etc.          |               |
| 2.5.3 Cache Memory  |               |
| <b>Unit 3. System Software:</b>                                       | <b>6 Hrs.</b> |
| 3.1 Importance of Operating Systems (OS)                              |               |
| 3.2 Types of Operating System   |               |
| 3.3 Functions of Operating System                                     |               |
| 3.3.1 Memory management   |               |

- 3.3.2 Device management
- 3.3.3 File management
- 3.3.4 Processor management
- 3.3.5 Security
- 3.4 MS-DOS
  - 3.4.1 System files: io.sys, msdos.sys, command.com, config.sys, autoexec.bat
  - 3.4.2 MS-DOS internal and external commands
- 3.5 Windows Operating System
  - 3.5.1 Graphical User Interface and windows environment, file/folder management
- 3.6 Linux: GNU open source operating system
- 3.7 Device driver

**Unit 4. Application Packages: 7 Hrs.**

- 4.1 Word Processing Software: Microsoft Word
- 4.2 Spreadsheet Software: Microsoft Excel
  - Entering data
  - Using formula
  - Basic calculations
  - Financial calculations
  - Charts
- 4.3 Presentation Software: Microsoft PowerPoint
- 4.4 Concept of Database management system
- 4.5 Database management package: Microsoft Access

**Unit 5. Utility Programs: 2 Hrs.**

- 5.1 Computer virus and its removal (antivirus programs)
- 5.2 File management and backup tools

**Unit 6. Networks and Internet: 7 Hrs.**

- 6.1 Introduction and advantages of computer networks
- 6.2 LAN, MAN and WAN
- 6.3 LAN Topologies: Bus, Ring, Star, Mesh, Tree and Hybrid
- 6.4 Transmission media: Guided and Unguided media
- 6.5 Network components: Hub, Switch, NIC, Router, Bridge etc.
- 6.6 Network Architecture: Peer to peer and Client-server network
- 6.7 Hardware and file sharing
- 6.8 Email/Internet
  - World Wide Web (WWW)
  - ISP
  - Search Engines
  - Web browsers: Internet Explorer, Netscape Navigator, Mozilla Firefox etc.,
  - Webpage and Website
  - Email

**Practical 30 Hrs.**

**Unit 1: Components of computer 10 Hrs.**

- 1.1 Identify major components of computer.
- 1.2 Familiarize with keyboard and mouse.
- 1.3 Identify Internal and External DOS commands

1.4 Apply Windows Graphical User Interface

1.5 Manage file/folder

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

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

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

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

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

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

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

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

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

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

### References

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

### Evaluation Scheme

#### Unit wise Marks division for Final Exam

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

**Second Year/First Semester**

## Fundamentals of Horticulture

(AG2101PS)

**Year: II**  
**Semester: I**

**Total: 6 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide basic knowledge in horticulture including the definition of horticulture, branches of horticulture, common horticultural terminologies, home gardening, rooftop gardening, semi-commercial and commercial vegetable production, commercial orchards, nurseries, orchard layouts, orchard management and other general farm operation.

### Course objectives:

After completion of this course students will be able to:

1. Explain about the concept of horticulture, pomology, olericulture and classification of major horticultural crops as temperate, sub-tropical and tropical fruits, citrus and its variability;
2. Identify the horticultural crops grown in different ecological regions of Nepal;
3. Describe about history of orchard establishment in Nepal;
4. Classify horticultural crops and identify their nutritional, economic, industrial and aesthetic importance;
5. Utilize the scope and comparative advantages of fruits, vegetables, and potato and spice crops;
6. Describe the principles of propagation, production and post-harvest management of horticultural crops in Nepal.

### Course Contents:

#### Theory

#### Unit 1: Introduction to Horticulture

**10 Hrs.**

- 1.1. Status, importance and scope of horticulture in Nepal
- 1.2. Describe horticulture, Pomology, olericulture, Floriculture and their scope of study
- 1.3. Role of horticulture in food and nutrition security and income generation in Nepal
- 1.4. Horticulture in Nepal: Policy perspective
- 1.5. Organization involved in horticulture development in Nepal (NARC, Government farm centers, commodity research station, I/NGOs, nurseries, private sectors, other organizations etc.).

#### Unit 2: Introduction to vegetable and crops

**10 Hrs.**

- 2.1. Classification of vegetables based on climatic requirements, methods of sowing, and longevity years, parts used as vegetables and horticultural classification.
- 2.2. Underutilized and indigenous vegetables of Nepal.
- 2.3. Major exportable spices (Ginger, turmeric, cardamom and Timur) of Nepal and their economic importance
- 2.4. Micro-climates and comparative advantages for year round vegetable production.
- 2.5. Concept of off-season vegetable production
- 2.6. Classify vegetables based on major nutrient contents (rich in carbohydrate, rich in proteins, rich in different vitamins and minerals)

- 2.7. Required quantities of green leafy, root and tubers, legumes and fruit vegetables for an average person in 24-hour cycle.
- 2.8. Introduction to vegetable nursery management, its need and advantages.
- 2.9. Different types of nursery beds and seedling growing (raised beds, sunken beds, plastic pots) techniques.
- 2.10. Role of home garden and roof-top garden in family nutrition.

**Unit 3: Plant Propagation** **10 Hrs.**

- 3.1. Definition of sexual and asexual propagation
- 3.2. Advantage and disadvantage of sexual and asexual propagation
- 3.3. Sexual propagation horticultural crops- flower structure, pollen and egg-cell formation,
- 3.4. Pollination, fertilization and seed formation
- 3.5. Dormancy
- 3.6. Germination
- 3.7. Seed treatment
- 3.8. Seeds: viability and germination
- 3.9. Seed dormancy and its causes
- 3.10. Breaking seed dormancy
- 3.11. Asexual method of propagation -cuttings, layering, grafting, use of special vegetative parts (bulb, corm, runner, rhizome, tuber and sucker) with examples  
Physiological basis of rooting
- 3.12. Micropropagation

**Unit 4: Introduction of fruit and plantation crops** **10 Hrs.**

- 4.1. Classification of fruits based on crop ecology with examples e. g. Temperate, Citrus, sub-tropical and. tropical fruits
- 4.2. Basic requirements of fruit nursery establishment based on crop ecology, mother stock, rootstock
- 4.3. Basic standards of fruit saplings of different fruit crops.
- 4.4. Concept and needs of pruning and training in fruit crops,
- 4.5. Different systems of pruning (Heading back, thinning out, pinching and disbudding)
- 4.6. Different methods of training (Central leader, modified leader, open center)
- 4.7. Systems and training of vines crops

**Unit 5: Irrigation and drainage** **5 Hrs.**

- 5.1. Function of irrigation in plants and water requirements of fruits and vegetables, wilting and indicator plant.
- 5.2. Methods of irrigation: Surface, sprinkler and drip irrigation.
- 5.3. Drainage: adverse effects of water logging and methods of drainage.
- 5.4. Describe critical growth stages of irrigation in fruits and vegetables.
- 5.5. Scheduling irrigation through manual soil moisture testing/monitoring or moisture depletion approach.

**Unit 6: Plant hormones – roles, function and horticultural application** **5 Hrs.**

**Unit 7: Concept of organic agriculture and constraints of organic farming in Nepal** **4 Hrs.**

**Unit 8: Post-harvest managements of horticultural crops** **6 Hrs.**

- 8..1. Ripening behavior of fruit (climacteric and non-climacteric)
- 8..2. Harvesting index and proper harvesting methods of fruits and vegetables
- 8..3. Different causes of post-harvest loss and extent of loss in fruits and vegetable
- 8..4. Introduction of preservation techniques of fruits and vegetables

### Practical

UNIT. 1	Identify horticultural crops available in college vicinity	2 Hrs.
UNIT. 2	Identify tools and equipment used in Horticulture	2 Hrs.
UNIT. 3	Visit orchard and observe fruit tree plantations adopted in the orchard	2 Hrs.
UNIT. 4	Practice cuttings	1 Hr.
UNIT. 5	Observe different systems of fruit tree training	1 Hr.
UNIT. 6	Observe different pruning system in fruit tree	1 Hr.
UNIT. 7	Practice of pruning in major vegetable	2 Hrs.
UNIT. 8	Practice of pinching in flower	1 Hr.
UNIT. 9	Practice off-season nursery preparation	2 Hrs.
UNIT. 10	Observe and sketch different types of plastic houses of vegetable	2 Hrs.
UNIT. 11	Practice mulching of fruit trees by grasses, dry leaves and plastic on transplanting beds of vegetables	2 Hrs.
UNIT. 12	Collect and classify of flowers according to flower structures	2 Hrs.
UNIT. 13	Identify different organic and inorganic manures and fertilizers and note their identification characters and colors	2 Hrs.
UNIT. 14	Collect compost making ingredients, prepare them and pile for composting using bamboo stick and decomposing effective micro-organism	2 Hrs.
UNIT. 15	Collect plastic drum and botanical ingredients having pungent, sour, bitter, astringent local plant leaves, fruits and cloves and urine and prepare liquid botanical pesticide	2 Hrs.
UNIT. 16	Collect ingredients for Bordeaux paste preparation. Follow appropriate procedure as guided by the instructor	2 Hrs.
UNIT. 17	Practices Gundruck making	2 Hrs.

### References:

1. Acquaah, G. (2019). *Horticulture: Principle and practices* (pp. 816). Pearson, USA.
2. Bal, J.S. (1990). *Fruit growing*. Kalyani Publishers, New Delhi, India.
3. Prasad, S. (1997). *Principles of horticulture*. Agro-Botanics, Bikaner.
4. Prasad, S. (2016). *Argo's dictionary of horticulture* (pp. 574). Scientific Publishers, India.
5. Shrestha, G. K., Shakya, S.M., Baral, D. R., & Gautam, D. M. (2001). *Fundamentals of horticulture*. Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal.

### Final written exam marking scheme

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

## Agro-metrology and Environmental Science

(AG2102PS)

**Year: II**  
**Semester: I**

**Total: 3 hours /week**  
**Lecture: 2 hours/week**  
**Tutorial: hour/week**  
**Practical: 2/2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the knowledge about agro-metrology and environmental science. The agro-metrology section covers introduction to atmospheric pressure, solar radiation, solar radiation, soil and air temperature, water vapor, precipitation and winds. The section of environmental science covers ecosystem principles and processes, natural resources, environmental pollution, global warming and climate change. This section also covers steps and legal provisions of environmental impact assessment in Nepal.

### Course objectives:

After completion of this course students will be able to:

1. Describe about aims, need and scope of agro meteorology;
2. Identify various atmospheric phenomenon and ways of measuring them;
3. Explain the importance of environment and natural resource conservation;
4. Identify the impact of pollution and climate change and measures to overcome them.

### Course Contents:

#### Theory

<b>Unit 1: Introduction to agro meteorology:</b>	<b>2 Hrs.</b>
1.1. Definitions, aims and scope of meteorology and agro meteorology	
1.2. Compare and contrast between weather and climate	
<b>Unit 2: Introduction to the atmosphere:</b>	<b>2 Hrs.</b>
2.1. Composition and vertical structure of atmosphere	
2.2. Introduction to atmospheric properties; temperature, humidity, density, and pressure present in different layers of earth's atmosphere Risk taking behavior and risk minimization	
<b>Unit 3: Atmospheric pressure:</b>	<b>2 Hrs.</b>
3.1. Measurement of pressure, types of barometers, barograph	
3.2. Pressure change with altitude, pressure variations	
<b>Unit 4: Solar radiation:</b>	<b>3 Hrs.</b>
4.1. Physical properties of radiation, direct solar radiation, diffused radiation, radiation transmission and absorption	
4.2. Long wave radiation, effective radiation, albedo	
4.3. Measurement of radiation and duration of sunshine	
<b>Unit 5: Air and soil temperature:</b>	<b>4 Hrs.</b>
5.1. Measurement of air and soil temperature	
5.2. Daily and annual variation of soil and air temperature	

- 5.3. Vertical and horizontal air temperature distribution, temperature inversion
- 5.4. Factors affecting soil temperature; frost and frost protection

**Unit 6: Water vapor and precipitation: 4 Hrs.**

- 6.1 Significant values and measurement of atmospheric humidity
- 6.2 Process of evaporation and its measurement from land and water surface
- 6.3 Type of precipitation and its measurement
- 6.4 Role of snow cover for plants and soil

**Unit 7: Winds: 2 Hrs.**

- 7.1 Causes and kinds of winds
- 7.2 Wind structure and its measurement

**Unit 8: Introduction to environmental studies: 1 Hr.**

- 8.1 Definition – need, objective and scope of environmental studies; Concept and role of environmental literacy in today’s scenario

**Unit 9: Ecosystem principles and processes: 1 Hr.**

- 9.1 Structure and functions of ecosystem; types of ecosystem services; agro-ecology as science, movement and practice

**Unit 10: Ecosystem principles and processes: 1 Hr.**

- 10.1 Structure and functions of ecosystem; types of ecosystem services; agro-ecology as science, movement and practice

**Unit 11: Ecosystem principles and processes: 4 Hrs.**

- 11.1 Structure and functions of ecosystem; types of ecosystem services; agro-ecology as science, movement and practice
- 11.2 Causes, effects and control measures of soil pollution – bioremediation – tolerable limits for heavy metals in soil
- 11.3 Causes, effects and control measures of thermal, marine and noise pollution
- 11.4 Issues related to pesticide misuse; banned pesticides of Nepal; ecological effects of pesticides

**Unit 12: Global warming and climate change: 3 Hrs.**

- 12.1 Atmospheric Greenhouse effect; cause, types and significance
- 12.2 Causes of climate change, impact of climate change on agriculture
- 12.3 Adaptation and mitigation strategies against climate change

**Unit 13: Definition, steps and legal provision of EIA in Nepal: 1 Hr.**

**Practical**

**Unit 1: Measure bright sunshine hours 1 Hr.**

**Unit 2: Estimate of heat indices 1 Hr.**

**Unit 3: Measure maximum and minimum temperature of air 1 Hr.**

**Unit 4: Measure maximum and minimum temperature of soil 1 Hr.**

**Unit 5: Measurement of wind speed and wind direction 1 Hr.**

<b>Unit 6: Measure rainfall</b>	<b>1 Hr.</b>
<b>Unit 7: Measure open pan evaporation</b>	<b>1 Hr.</b>
<b>Unit 8: Determine vapor pressure and relative humidity</b>	<b>1 Hr.</b>
<b>Unit 9: Identify the components of ecosystem in the locality</b>	<b>1 Hr.</b>
<b>Unit 10: Describe ecosystem services provided by forest/natural ecosystem</b>	<b>1 Hr.</b>
<b>Unit 11: Record the ways followed by farmers to minimize the harmful effect of chemical pesticides</b>	<b>1 Hr.</b>
<b>Unit 12: Determination of dissolved solid in waste water sample</b>	<b>1 Hr.</b>
<b>Unit 13: Determine minimum quadrat size for the herbaceous vegetation by species area curve method</b>	<b>1 Hr.</b>
<b>Unit 14: Examine insitu or exsitu conservation center in nearby area</b>	<b>1 Hr.</b>
<b>Unit 15: Observe the environmental externalities and waste management strategies followed in a local industry</b>	<b>1 Hr.</b>

**References:**

1. Mahi, G.S., & Kingra, P.K. (2015). *Fundamentals of agrometeorology*. Kalyani Publishers, New Delhi, India.
2. Reddy, S. R., & Reddy, D.S. (2014). *Agrometeorology*. Kalyani Publishers, New Delhi.
3. Reddy, S. R. (2014). *Introduction to agriculture and agrometeorology*. Kalyani Publishers, New Delhi, India.
4. Bharucha, E. (2005). *Textbook of environmental studies for undergraduate courses*. University Grants Commission, University Press, Hyderabad, India.
5. Manohara chari, C., & Reddy, J.R. (2004). *Principles of environmental studies*. BS Publication, Hyderabad, India.

**Final written exam marking scheme**

Unit	1	2	3	7	4	5	6	8	9	10	13	11	12	Total
Unit Hours	2	2	2	2	3	4	4	1	1	1	1	4	3	30
Marks	5		5		5	5	5	5				5	5	40

## Irrigation, Farm Mechanization and Farm Structures

(AG2103PS)

**Year: II**  
**Semester: I**

**Total: 3 hours /week**  
**Lecture: 2 hours/week**  
**Tutorial: hour/week**  
**Practical: 2/2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the knowledge and skills on irrigation and drainage management, farm mechanization, construction of farm building and storage structures. The course deals with history of irrigation need of irrigation, methods of irrigation, irrigation structures, drainage management, erosion control and diversion structures. The farm mechanization aspect of the course includes introduction and uses of agricultural tools, tractors and its accessories, various types of ploughs, sowing and planting machines, threshing machines and irrigation pumps. The part of course designed for farm structure gives knowledge on farm building and storage structures: materials for construction materials, types of farm buildings and its components- foundation, floor, walls, framed structure, RCC etc., different animal keeping structures- dairy cattle house and stanchion barn, Free stall and loose housing, pen house, and milking parlor; poultry house for deep litter housing and silo for fodder storage structures.

### Course objectives:

After completion of this course students will be able to:

1. Describe the importance of irrigation for agricultural intensification and productivity gains;
2. Determine the depth of irrigation and schedule irrigation;
3. Apply different irrigation methods, construction of different structures for water conveying channel and drainage system, control water logging;
4. Identify parts of a tractor, accessories, tools, indigenous devices and their uses in agricultural operations;
5. Identify the construction materials for building and storage structure (clay, brick, water, cement, sand, gravel, mortar, concrete);
6. Estimate required construction materials and planning an animal keeping houses- cow, poultry and silo storage structures.

### Course Contents:

#### Theory

**15 Hrs.**

#### Unit 1: Irrigation:

- 1.1. Definition, objectives, merits and demerits of irrigation
- 1.2. History of development and scope of irrigation in Nepal
- 1.3. Soil water, its type, use of soil moisture, soil moisture retention and movement
- 1.4. Soil moisture constants
  - 1.4.1 Classes of soil water, apparent specific gravity, soil moisture extraction pattern and critical stages of crops with respect to soil moisture
  - 1.4.2 Infiltration, percolation, intake rate, permeability, hydraulic conductivity, seepage and inflow
- 1.5. Irrigation scheduling, determination of depth and frequency of irrigation, to know when to irrigate and how much to irrigate

- 1.5.1 Definition and objectives of irrigation scheduling, soil water availability law, allowable soil moisture depletion, readily available moisture,
- 1.5.2 Depth of irrigation; net irrigation requirement, field irrigation requirement and gross irrigation requirement and frequency of irrigation
- 1.5.3 Base period; paleo irrigation, kor watering, effective rainfall, intensity of irrigation, consumptive use, duty and delta, calculation
- 1.5.4 Indicators of irrigation scheduling and simple methods to determine when to irrigate for farmers
- 1.6 Introduction to different Irrigation methods and parameters for irrigation methods,
  - 1.6.1 Surface irrigation methods:
  - 1.6.2 sub-surface and drip irrigation method
  - 1.6.3 Sprinkler irrigation methods
  - 1.6.4 Newly developing irrigation techniques- surge flow, discrete irrigation in furrow, capillary irrigation (CIS-RM)
- 1.7 Introduction to drop structure, spillway, inverted siphon, culvert, aqueduct, diversion box, weir, parshall flume, orifices
- 1.8 Necessity of drainage management in cropped field
  - 1.8.1 Definition, water logging and its effects, causes of water logging; critical water logging duration, drainage coefficient; numerical problems

**Unit 2: Farm Mechanization: 7 Hrs.**

- 2.1 Availability and limitations of different sources of farm power
- 2.2 Nepalese indigenous agriculture tools: Introduction, structural details, function and comparison with modern machines
- 2.3 Introduction to tractor and their types
- 2.4 Definition and objectives of tillage, Operation and management of primary and secondary tillage implements
- 2.5 Types of seeding machines and types of furrow openers planting machines for major crops
- 2.6 Definition, Components and types of rice and wheat threshing machines, combines
- 2.7 Aquifer, types of pumps: reciprocating pumps, Centrifugal pumps, Turbine pumps and Propeller pumps

**Unit 3: Farm building and storage structures: 8 Hrs.**

- 3.1 Types of farm buildings and its components
  - 3.1.1 Load bearing and framed structure, its types
  - 3.1.2 Building components: foundation, walls and pillars, openings (door and windows), floor, bands (plinth, lintel, gable), roof and cantilever
- 3.2 Earthwork, soling, DPC: dampness and its' effect and prevention, RCC, PCC, curing, centering and shuttering
- 3.3 Planning and layout of different farm buildings and storage structures
  - 3.3.1 Dairy cattle house and stanchion barn, free stall and loose housing, pen house, and milking parlor
  - 3.3.2 Poultry house for deep litter housing
  - 3.3.3 Feed and grain storage structure
  - 3.3.4 silo for fodder storage structures

### Practical

Unit 1: Determine soil moisture content (by Tensiometer and Soil moisture meter)	2 Hrs.
Unit 2: Determine soil moisture content (By using gravimetric method, feel and appearance method)	2 Hrs.
Unit 3: Determine soil moisture content (By using gravimetric method, feel and appearance method)	2 Hrs.
Unit 4: Measure infiltration capacity of soil (Use of double ring infiltrometer)	2 Hrs.
Unit 5: Identify and use tools, their repair and maintenance	2 Hrs.
Unit 6: Study country plough, mould board plough and disc plough	2 Hrs.
Unit 7: Assess indigenous local agriculture tools, instruments and machines, collection and compare with modern machines	1 Hr.
Unit 8: Calculate and estimate structure materials	2 Hrs.

### References:

#### For irrigation:

1. Michael, A.M. (2008). *Irrigation theory and practice*. Vikas Publishing house Pvt. Ltd., New Delhi, India.
2. Modi, P.N. (2000). *Irrigation water resources and water power engineering* (4<sup>th</sup> ed.). Standard book house, Delhi, India.
3. Manandhar, B.D. (1999). *Optimization technology for discrete watering in furrows* (Dissertation, pp. 269). Kishinev, (Russian language).
4. Manandhar, B.D. (2016). *Laboratory manual principles and practices of farm water management*. Maitreya Agri-Engineering industry, Chitwan, Nepal.
5. Shankara Reddi G.N., & Yellamanda Reddy, T. (1995). *Efficient use of Irrigation water*. Kalyani Publishers, New Delhi, India.
6. Sharma, R.K., & Sharma, T.K. (2002). *Irrigation engineering*. S. Chand and Company Ltd., New Delhi, India.
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### Final written exam marking scheme

Unit	1	2	3	Total
Unit Hours	15	7	8	30
Marks	20	10	10	40

## Fundamentals of Agronomy

(AG2104PS)

**Year: II**  
**Semester: I**

**Total: 6 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the students with knowledge on the science of Agronomy means of food production along with a thorough understanding of the scientific principles involved. The course deals with offering technical knowhow to the students about the operational procedures essential during crop cultivation with the logics behind.

### Course objectives:

After completion of this course students will be able to:

1. Describe the importance and status of crop production;
2. Identify the factors affecting crop production;
3. Perform field and soil management;
4. Perform effective crop growing and postharvest of cereal crops;
5. Organize a sustainable crop farm.

### Course Contents:

#### Theory

<b>Unit 1: Agronomy, definition, scope and role in food security</b>	<b>3 Hrs.</b>
1.1. Evolution of the Agriculture and Green Revolution	
1.2. Agronomy and Relationship of Agronomy with other branches of science	
1.3. Food production and food security status in world and in Nepal	
<b>Unit 2. Crops and their classification</b>	<b>2 Hrs.</b>
2.1 Basis of classification and crop classes	
<b>Unit 3. Factors affecting crop production</b>	<b>7 Hrs.</b>
3.1 Climate and weather: Solar radiation and relation to greenhouse effect	
3.2 Temperature and Growing Degree Days, Soil temperature	
3.3 Precipitation, Wind and Relative Humidity	
3.4 Seasonal variation in Nepal and effect on Agriculture	
3.5 Soil factors: concept of land/soil suitability	
3.6 Socio-economic factors	
<b>Unit 4. Tillage</b>	<b>8 Hrs.</b>
4.1 Tillage and types of tillage	
4.2 Tillage for different crops - Basis of tillage manipulation	
4.3 Tillage tools and equipment	
4.4 Minimum tillage and practice of conservation farming	
<b>Unit 5. Seed and seed sowing</b>	<b>10 Hrs.</b>
5.1 Seed, its diversity and importance	
5.2 Seed dormancy and germination	

5.3	Seed quality and quality seed	
5.4	Classes of seed in Nepal	
5.5	Sowing/Planting of crops	
5.6	Plant population and crop yield	
<b>Unit 6. Plant Nutrient Management</b>		<b>5 Hrs.</b>
6.1	Plant nutrients required by the plants	
6.2	Manures and Fertilizers	
6.3	Green and Brown Manuring	
6.4	Biofertilizers and their use	
6.5	Field application of manures and fertilizers	
<b>Unit 7. Weed in crop production</b>		<b>8 Hrs.</b>
7.1	Weeds and their effect on crop production	
7.2	Problematic weeds in Nepal	
7.3	Weed management: Cultural and Physical weed management	
7.4	Weed management: Chemical weed management	
<b>Unit 8. Field water management</b>		<b>3 Hrs.</b>
8.1	Soil moisture constants	
8.2	Irrigation and types of irrigation	
8.3	Drainage and types of drainage	
<b>Unit 9. Harvesting, Storage and post harvesting technology</b>		<b>6 Hrs.</b>
9.1	Time for judgments to harvesting	
9.2	Principles and practices of storage	
9.3	Post-harvest technology	
<b>Unit 10. Sustainable agriculture</b>		<b>8 Hrs.</b>
10.1	Negative impact of green revolution	
10.2	Principles and Concept of agricultural sustainability	
10.3	Organic farming and Permaculture	
<b>Practical</b>		
<b>Unit 1: Agronomy in food production</b>		<b>2 Hrs.</b>
1.1	Participatory discussion on Agronomy and food situation in the locality	
<b>Unit 2: Drawing linkage among Agronomy, market and economy</b>		<b>2 Hrs.</b>
2.1	Internalize Agronomy as a source of food, living and earning	
<b>Unit 3: Classification of crops considering various bases</b>		<b>2 Hrs.</b>
3.1	Classify the available crops based on various parameters in the location	
<b>Unit 4: Understanding the relationship between crops and weather</b>		<b>4 Hrs.</b>
4.1	Understanding the effect of rainfall and temperature on crops	
4.2	Introduction to meteorological devices	
4.3	Seasonal calendar for the crops available in the region	
4.4	Draw a relationship between crops and topography	
<b>Unit 5: Tillage</b>		<b>2 Hrs.</b>
5.1	Introduction to the tools and tillage equipment	
5.2	Practice on field preparation	
<b>Unit 6: Weed in crop production</b>		<b>3 Hrs.</b>
6.1	Identification of weeds of major crops and study their growing habit	
6.2	Assess the damage caused by the weeds	

6.3	Preparation of herbarium of major weeds	
6.4	Intercultural operation for weed management	
6.5	Familiarization with herbicides	
<b>Unit 7: Seed and seed sowing</b>		<b>3 Hrs.</b>
7.1	Identification of various crop seeds	
7.2	Practice on purity and germination test	
7.3	Practice on sowing/planting the crop with amount of seed calculated	
<b>Unit 8. Water management</b>		<b>2 Hrs.</b>
8.1	Judging the need of crops for irrigation	
8.2	Practice on the irrigation scheduling for the given crop	
<b>Unit 9. Basics of crop protection</b>		<b>3 Hrs.</b>
9.1	Identification of the major diseases of the major crop in the locality	
9.2	Identification of the major insect pests of the major crop in the locality	
9.3	Practice on the formulation of pesticide for use	
<b>Unit 10. Harvesting and post harvesting technology</b>		<b>2 Hrs.</b>
10.1	Practice on judging the time for harvest of available crop/s	
10.2	Harvesting practice of various crops	
<b>Unit 11. Sustainable agriculture</b>		<b>5 Hrs.</b>
11.1	Cropping scheme for irrigated and dry land agriculture	
11.2	Study of degraded lands	
11.3	Visit to an organic farm to observe various components and utilization	
11.4	Profitable utilization of agricultural wastes	
11.5	Preparation of integrated farming system model	

**References:**

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**Final written exam marking scheme**

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

## Agriculture Entomology

(AG2105PS)

**Year: II**  
**Semester: I**

**Total: 9 hours /week**  
**Lecture: 5 hours/week**  
**Tutorial: hour/week**  
**Practical: 4 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the knowledge about insects in agriculture crops and its management practices. this course covers the general characteristics of insects, their classification, food habits, life cycle, type of beneficial organisms; plant protection measures like cultural, mechanical, biological, HPR, physical, chemical and IPM. The course also describes the details of pesticides like pesticide classification, mode of actions, pesticide formulations, toxicity level of pesticide, safe use of pesticide, pesticide symptoms and first aid practices, methods of pesticide application, pesticide spraying techniques, pesticide appliances, pesticide calculation and compatibilities.

### Course objectives:

After completion of this course students will be able to:

1. Identify pest, their food habit, life cycle and their diagnostic characteristics;
2. Practice integrated approaches of pest management;
3. Formulate and apply pesticides;
4. Describe pesticide act and select the suitable pesticide;
5. Operate sericulture and apiculture

### Course Contents:

#### Theory

#### Unit 1: Introduction to Entomology

**4 Hrs.**

- 1.1 Definition, importance and scope of Entomology
- 1.2 General concept of pest, insect, pesticides
- 1.3 Harmful insects and beneficial insects
- 1.4 Reasons for the dominance of insects over other animals

#### Unit 2: Insect External Morphology

**7 Hrs.**

- 2.1 Body regions of insect (head, thorax and abdomen), external processes, and cuticle
- 2.2 Segmentation and structure insects head and thorax
- 2.3 Mouth parts and their modifications
- 2.4 Antennae and their modifications
- 2.5 Photoreceptors- compound eyes, ocelli and stemmata
- 2.6 Legs and wings, and their modifications
- 2.7 Segmentation & structure of abdomen, common appendages and its significance.

#### Unit 3: Insect Life Cycle

**3 Hrs.**

- 3.1 General characteristics and life cycle of insect
- 3.2 Metamorphosis and development of insects (simple and complete)
- 3.3 Metamorphosis and development of insects (incomplete, paurometabola)

- Unit 4: Insects** **6 Hrs.**
- 4.1. General characteristics of insect of different order and families
  - 4.2. Insect classification (description of order and important families of the orders)
    - 4.2.1 Hemiptera and Homoptera,
    - 4.2.2 Lepidoptera,
    - 4.2.3 Coleoptera,
    - 4.2.4 Hymenoptera and Diptera
    - 4.2.5 Thysanura, Odonata, Dictyoptera, Orthoptera and others of economic importance
- Unit 5: Insect pest management practices** **8 Hrs.**
- 5.1 General concept of insect pest management;
  - 5.2 Reason for increasing insect pest populations and its management
  - 5.3 Economic levels (economic threshold level and economic injury level)
  - 5.4 Physical method and mechanical method
  - 5.5 Cultural method and biological
  - 5.6 Genetical method/use of resistant varieties and regulatory method
  - 5.7 Chemical method
  - 5.8 Integrated pest management
- Unit 6: IPM** **15 Hrs.**
- 6.1. Introduction
  - 6.2. Principles of Farmers Field School (FFS)
  - 6.3. Roles and responsibilities of stakeholders
  - 6.4. Basic requirements of FFS/ Describe FFS
  - 6.5. Comprehensive planning and preparatory meetings
  - 6.6. Principle, AESA parameters and layout of agro-ecosystem analysis (AeSA)
  - 6.7. Criteria of running FFS meeting (Norms, Attendance, group division)
  - 6.8. Concepts of experiments; Natural variation, bias, replication, treatments, plot size, sample size and methods, Observation parameters and frequency for experiments)
  - 6.9. Field selection criteria for studies and group dynamics
  - 6.10. Crop physiology /growth stages critical stages of crop / its inputs requirement
  - 6.11. Group dynamics
- Unit 7: Internal anatomy of insect (Different parts and functions)** **5 Hrs.**
- 7.1 Digestive system
  - 7.2 Reproductive system
  - 7.3 Respiratory system
  - 7.4 Circulatory system
  - 7.5 Nervous and excretory system
- Unit 8: Pesticides (commonly used pesticides in Nepal)** **7 Hrs.**
- 8.1 Pesticides used in agriculture (Insecticides, Fungicides, Acaricides, Rodenticides & others)
  - 8.2 Formulation of pesticides
  - 8.3 Toxicity of pesticides
  - 8.4 Pesticide calculations
  - 8.5 Pesticides compatibilities
  - 8.6 Farmer practices on use and misuse of pesticides
  - 8.7 Pesticides poisoning symptoms and first aid measures

<b>Unit 9: Methods of pesticides application</b>	<b>3 Hrs.</b>
9.1 Pesticides application methods: types, general features	
9.2 Seed treatment	
9.3. Soil application and foliar application	
<b>Unit 10: Plant protection equipment</b>	<b>3 Hrs.</b>
10.1 Introduction: Sprayer, dusters and its types	
10.2 Care, troubleshooting and maintenance of equipment	
10.3 Calibration of sprayers and its importance	
<b>Unit 11: Pesticide act</b>	<b>3 Hrs.</b>
11..1. Current pesticide act, rules, regulations and standards	
11..2. Listed and banned pesticides in Nepal	
11..3. Licensing process for pesticide business	
<b>Unit 12: Important insect-pests of crops and their management</b>	<b>6 Hrs.</b>
12.1 Important insect pests of cereals (Rice, maize, wheat)	
12.2 Important insect pests of seasonal vegetables	
12.3 Important insect pests of fruits- mango, litchi, citrus, banana and apple	
12.4 Important insect pests of tea and coffee	
12.5 Important insect pests of legumes	
12.6 Stored grain insect pests and their identification	
<b>Unit 13: Introduction to Industrial Entomology</b>	<b>5 Hrs.</b>
13.1 Apiculture	
13.1.1 Introduction to apiculture and honey bee species	
13.1.2 Life cycle of honey bees	
13.1.3 Bee hive and seasonal management	
13.2 Sericulture	
13.2.1 Introduction to sericulture	
13.2.2 Life cycle of mulberry silkworm and its management	
<b>Practical</b>	
Unit 1: Identify tools and equipment used in insect pest management	2 Hrs.
Unit 2: Describe External morphology of an insect	2 Hrs.
Unit 3: Describe internal anatomy of an insect	2 Hrs.
Unit 4: Identify of insects feeding habits/mouth parts of insects	2 Hrs.
Unit 5: Describe insect metamorphosis (complete and incomplete)	2 Hrs.
Unit 6: Identify seasonal insect pests in the field (beneficial and harmful)	2 Hrs.
Unit 7: Collect and preserve economically important insect pests (harmful)	2 Hrs.
Unit 8: Identify common pesticides available in Nepal & their label and uses	2 Hrs.
Unit 9: Identify commonly available insecticide in local market	2 Hrs.
Unit 10: Formulate, calibrate, dilute and apply pesticides	2 Hrs.
Unit 11: Use of common botanical materials as pesticides	2 Hrs.
Unit 12: Identify precautionary measures of pesticide use, and safe disposal	2 Hrs.
Unit 13: Study life cycle of honey bee	2 Hrs.
Unit 14: Study life cycle of mulberry silkworm	2 Hrs.
Unit 15: Study Modern bee hive, its parts and safety measures	2 Hrs.
Unit 16:	30 Hrs
16.1. Prepare cropping calendar, seasonal calendar and social map including FFS	
16.2. Conduct FFS	

- 16.3. Conduct experiment on (Comparative study of IPM Vs Farmers field, Compensation trial and
- 16.4. Experimental design based)
- 16.5. Conduct FFS of one seasonal crop on (Soil texture, water holding capacity, Seed germination,
- 16.6. Zoo and cup study)
- 16.7. Conduct Agro-ecosystem analysis
- 16.8. Perform Ballot Box Test (BBT)
- 16.9. Organize farmer's field day

### References:

1. Yubak, G.C. (2012). Status of pesticide use in Nepal and efforts of plant protection directorate towards the pesticide reduction. *Journal of Plant protection society*, 3, 1-13.
2. Luckmann, H.W., & Metcalf, R.L. (1982). *Introduction to insect pests management: Management of soil pests*. HELMITAS, Lalitpur, Nepal.
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### Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Unit Hours	4	7	3	6	8	15	5	7	3	3	3	6	5	75
Marks	5	5	5	5	10	15	5	5	5	5	5	5	5	80

## Fundamentals of Soil Science

(AG2106PS)

**Year: II**  
**Semester: I**

**Total: 6 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the basic knowledge of soil, its uses, evolution, composition and soil formation process. The course includes soil physical components- solid, liquid and gaseous phases; physical properties, Soil wetness, soil chemical properties, soil colloidal properties, ecological functions of soil, types of macro and microorganisms, and their significance in agriculture. The course also includes physiographic regions of Nepal and agricultural limitation in the regions.

### Course objectives:

After completion of this course students will be able to:

1. Identify and describe the fundamentals of soil constituents;
2. Identify and describe the soil forming factors and basic pedogenic process;
3. Test pH of soil and prescribe activities for the improvement of problematic soil;
4. Identify and explain physical, chemical and biological properties of soil;
5. Apply information of soil physical, chemical and biological properties of soil in relation to crop production;

### Course Contents:

#### Theory

<b>Unit 1: Introduction to soil:</b>	<b>5 Hrs.</b>
1.1. Definition and concept	
1.2. Historical development of soil science	
1.3. Soil as a dynamic body	
1.4. Soil as a medium for plant growth and other uses of soil	
1.5. Soil-plant relationship	
<b>Unit 2: Soil formation:</b>	<b>6 Hrs.</b>
2.1. Evolution and composition of earth	
2.2. Basic pedogenic processes of soil development	
2.3. Soil forming rocks and minerals	
2.4. Mechanism of weathering of rocks and minerals	
<b>Unit 3: Soil physical properties:</b>	<b>8 Hrs.</b>
3.1. Soil as three phase system	
3.2. Soil texture – types and importance	
3.3. Soil structure- types and stability	
3.4. Density characteristics- Bulk density, particle density, and porosity	
3.5. Soil color and significance in agriculture	
3.6. Soil consistency- dry, moist and wet	
<b>Unit 4: Soil water, air and thermal properties:</b>	<b>18 Hrs.</b>
4.1. Quantitative concepts of water	
4.2. Properties and importance of water in soil water plant relationships	

- 4.3. Soil water energy concepts- concepts and components
- 4.4. Capillary mechanisms
- 4.5. Soil moisture characteristic curves
- 4.6. Soil water movement in saturated condition
- 4.7. Soil water movement in unsaturated condition
- 4.8. Soil aeration and movement in soil
- 4.9. Heat transfer in soil
- 4.10. Management of air and heat in agricultural field
- 4.11. Infiltration characteristics of soils
- 4.12. Water harvesting techniques
- 4.13. Soil erosion by water
- 4.14. Splash/sheet erosion- mechanism and significance in nutrient management
- 4.15. Surface sealing, management and its effects on soil and crop growth
- 4.16. Structural management in arable soils and soil conservation.

**Unit 5: Soil chemical properties: 12 Hrs.**

- 5.1. Soil colloids- general properties
- 5.2. Types of soil colloids
- 5.3. Silicate clays and their fundamentals
- 5.4. Expanding and non-expanding clay minerals
- 5.5. Ion exchange and importance in agriculture
- 5.6. Soil pH, soil acidity and types

**Unit 6: Biological Properties of soil: 7 Hrs.**

- 6.1 Introduction, soil as habitat for organisms
- 6.2 Organisms in soil (types)- soil flora and fauna
- 6.3 Macroorganisms in soil- earthworm, termites, plant roots
- 6.4 Microorganisms in soil- Bacteria, Fungi, Actinomycetes
- 6.5 Microbial decomposition of organic residues
- 6.6 Nitrogen fixing microbes and their plant association
- 6.7 Legume-bacteria (Rhizobium) symbiosis relationship

**Unit 7: Land unit, land forms and physiographic regions of Nepal: 4 Hrs.**

- 7.1 Land use system, land forms and land unit
- 7.2 Indigenous land classification system in Nepal
- 7.3 Scientific classification system of Nepal
- 7.4 Physiographic regions of Nepal

**Practical**

- |   |        |
|---|--------|
| Unit 1: Identify tools & equipment used in soil lab                 | 2 Hrs. |
| Unit 2: Differentiate low land and upland soil profiles             | 2 Hrs. |
| Unit 3: Prepare a soil sample                                       | 2 Hrs. |
| Unit 4: Determine of soil texture by feel method                    | 2 Hrs. |
| Unit 5: Determine of soil consistence by feel methods               | 2 Hrs. |
| Unit 6: Determine of bulk density of soil                           | 2 Hrs. |
| Unit 7: Determine of particle density of soil                       | 2 Hrs. |
| Unit 8: Compare bulk density, particle density and porosity of soil | 2 Hrs. |
| Unit 9: Observe capillary phenomena in different textured soil      | 2 Hrs. |
| Unit 10: Determine mass water content                               | 2 Hrs. |
| Unit 11: Calculate water quantities                                 | 2 Hrs. |

Unit 12: Determine soil pH	2 Hrs.
Unit 13: Determine electrical conductivity of soil	2 Hrs.
Unit 14: Identify major soil forming rocks found in Nepal	2 Hrs.
Unit 15: Identify major soil forming minerals found in Nepal	2 Hrs.

**References:**

1. Brady, N.C. (2015). *The nature and properties of soils* (14<sup>th</sup> ed.). Macmillan Publishing Co., New York.
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**Final written exam marking scheme**

Unit	1	2	3	4	5	6	7	Total
Unit Hours	5	6	8	18	12	7	4	60
Marks	5	10	10	25	15	10	5	80

## Introductory Animal Husbandry

(AG2107AS)

**Year: II**  
**Semester: I**

**Total: 6 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the information on status, importance, scope and challenges of livestock production in Nepal. The course intends to provide knowledge and skills on identifying different physiological stages, feeding, breeding, housing and treatment requirement of animals. The course covers the general production practices of livestock production.

### Course objectives:

After completion of this course students will be able to:

1. Understand the importance and scope of livestock farming;
2. Explore the physiological stages of animals;
3. Analyze feeding, breeding, housing and treatment requirement of animals;
4. Run a livestock farm efficiently.

### Course Contents:

#### Theory

- Unit 1: Introduction to animal husbandry: 3 Hrs.**
- 1.1. Common Terminologies related to Animal Husbandry
  - 1.2. Zoological Classification of Common domestic animals
  - 1.3. Scope , Importance & Challenges of Livestock production in Nepal
  - 1.4. Livestock population, Distribution and its contribution to GDP
  - 1.5. Inter relationship of livestock farming with other branches of Agriculture
  - 1.6. Difference between Ruminants & Non-Ruminants
- Unit 2: Anatomy & physiology of farm animals: 14 Hrs.**
- 2.1. Organs related & physiology of Digestion in ruminants
  - 2.2. Organs related & physiology of Digestion in non-ruminants
  - 2.3. Organs related & physiology of male reproduction
  - 2.4. Organs related & physiology of female reproduction
  - 2.5. Hormones and their role reproductive mechanism
  - 2.6. Basic concept of estrus cycle, Detection of heat, ovulation and fertilization
  - 2.7. Animal Blood: Functions & components
  - 2.8. Anatomy & physiology of mammary gland
  - 2.9. Milk Composition & Nutritive Value
- Unit 3: Animal Nutrition & Feeding management: 10 Hrs.**
- 3.1. Definition of animal nutrition,
  - 3.2. Classification of Feedstuffs
  - 3.3. Different nutrients required to animal
  - 3.4. Physiological functions, source & deficiency symptoms of Water, Carbohydrates & Lipids

- 3.5. Physiological functions, source & deficiency symptoms of Vitamin & Minerals
- 3.6. Physiological functions, source & deficiency symptoms of Protein
- 3.7. Cultivation practices of Common legume & Non Legume forage
- 3.8. Introduction to the pasture/Range and the high hill animal grazing system
- 3.9. Commonly grown fodder trees and their role in livestock feeding
- 3.10. Ration Formulation and feeding for different age group of livestock

**Unit 4: Animal Breeding & Artificial Insemination: 5 Hrs.**

- 4.1. Definition, uses and recent advancement of animal breeding
- 4.2. System of Breeding
- 4.3. Methods of Selection
- 4.4. Artificial insemination: definition, Importance & Challenges in our context
- 4.5. AI Technique
- 4.6. Rectal palpation method for pregnancy diagnosis

**Unit 5: Cattle/Buffalo production & Management: 7 Hrs.**

- 5.1. Common Indigenous & Exotic breed of Cattle found in Nepal
- 5.2. Common Indigenous & Exotic breed of Buffalo found in Nepal
- 5.3. Housing management & Space Requirement for Different age group of cattle/buffalo
- 5.4. Care & management of Newly born calf, Heifers, pregnant mother, Lactating Animals, Breeding bull
- 5.5. Economics & Importance of Cattle/Buffalo farming

**Unit 6: Sheep/Goat production & Management: 6 Hrs.**

- 6.1 Common Indigenous & Exotic breed of Sheep found in Nepal
- 6.2 Common Indigenous & Exotic breed of Goat found in Nepal
- 6.3 Housing management & Space Requirement for Different age group of Sheep/Goat
- 6.4 Care & management of Newly born kid, pregnant & Lactating Animals, Breeding buck
- 6.5 Economics of Sheep/Goat Farming

**Unit 7: Swine production & Management: 4 Hrs.**

- 7.1 Common Indigenous & Exotic breed of Swine found in Nepal
- 7.2 Housing management & Space Requirement for Different age group of Swine
- 7.3 Care & management of piglet, pregnant & Lactating Sow, Breeding boar
- 7.4 Economics of pig Farming

**Unit 8: poultry production & Management: 6 Hrs.**

- 8.1 Common Indigenous & Exotic breed of fowl found in Nepal
- 8.2 Housing management & Space Requirement for Different age group of birds.
- 8.3 Care & management of day-old chicks, pullet, rooster & laying hen
- 8.4 Basic of Broiler farming
- 8.5 Basic of Layer farming
- 8.6 Economics & Importance of Poultry Farming

**Unit 9: Routine Farm Operation: 5 Hrs.**

- 9.1 Identification of farm animals
- 9.2 De budding, Dehorning, Docking
- 9.3 Castration: Importance & Methods

- 9.4 Farm Record Keeping  
 9.5 Body Weight Calculation for different farm animals

**Practical**

Unit 1:	Study on digestive system of Ruminant	2 Hrs.
Unit 2:	Study on digestive system of non-ruminant & poultry birds	4 Hrs.
Unit 3:	Study on Reproductive system of Male Animals	3 Hrs.
Unit 4:	Study on Reproductive system of Female Animals	3 Hrs.
Unit 5:	Study on Reproductive system of poultry birds	3 Hrs.
Unit 6:	Tagging of farm Animals	3 Hrs.
Unit 7:	Disbudding on newly born calf	2 Hrs.
Unit 8:	Debeaking on poultry birds	2 Hrs.
Unit 9:	Live body weight calculation using formula in cow, goat, pig	2 Hrs.
Unit 10:	Identification of common Grasses & Fodder	2 Hrs.
Unit 11:	Ration Formulation for different livestock	2 Hrs.
Unit 12:	Visit Nearby AI Center and gain experience about AI	2 Hrs.

**References:**

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

**Final written exam marking scheme**

Unit	1	2	3	4	5	6	7	8	9	Total
Unit Hours	3	14	10	5	7	6	4	6	5	60
Marks	5	15	15	5	10	10	5	10	5	80

**Second Year/ Second Semester**

## Soil Fertility Management

(AG2201PS)

**Year: II**  
**Semester: II**

**Total: 6 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the knowledge and skills on plant nutrition for sustainability of agriculture. The course deals with sources, functions, deficiency symptoms of plant nutrients, soil fertility evaluation, organic matters and their properties, organic manures and their types, preparation of organic manures (FYM, compost, green manures), bio fertilizers and their types, biogas and slurry, composition, uses and behavior of nitrogenous, phosphatic, potassic fertilizers in soil, integrated nutrient management-components and relevance, agriculture sustainability- definition, causes of unsustainability, land degradation, its consequences, soil factor (abiotic) as important component of Plant Health Clinic.

### Course objectives:

After completion of this course students will be able to:

1. Identify the functions and deficiency symptoms of nutrients in plants;
2. Apply strategies to maintain soil fertility and soil conservation;
3. Identify various types of fertilizers and their nutrient content;
4. Perform soil tests;
5. Apply sustainable soil management practices.

### Course Contents:

#### Theory

#### Unit 1: Introduction to Soil Fertility:

**5 Hrs.**

- 1.1. Definition and concept of soil fertility & productivity
- 1.2. Overview of historical development of soil fertility
- 1.3. Limiting factors for plant growth and development
- 1.4. Law of Minimum
- 1.5. Yield potential and yield gap

#### Unit 2: Plant Nutrition:

**20 Hrs.**

- 2.1. Definition of nutrition and plant nutrition
- 2.2. Primary and Secondary plant nutrients
- 2.3. Sources of nutrients
- 2.4. Functions and deficiency symptoms
- 2.5. Visual symptoms of nutrient deficiency
- 2.6. Plant tissue analysis to identify deficiency
- 2.7. Biological method of identifying deficiency symptoms
- 2.8. Soil tests
- 2.9. Soil fertility evaluation

- Unit 3: Fertilizers:** **5 Hrs.**
- 3.1. Nitrogenous fertilizers
  - 3.2. Phosphatic fertilizers
  - 3.3. Potassic fertilizers

- Unit 4: Soil organic matter:** **5 Hrs.**
- 4.1. Sources, types and their importance in crop production
  - 4.2. SOM- composition, decomposition and humus formation
  - 4.3. C:N ratio and carbon sequestration for soil health

- Unit 5: Organic manures and biochar:** **7 Hrs.**
- 5.1. Organic manures- types and their properties
  - 5.2. Preparation of organic manures (FYM, compost, vermicompost)
  - 5.3. Bio-fertilizers and green manuring
  - 5.4. Biogas- slurry management and its importance in agriculture
  - 5.5. Biochar-introduction, preparation and importance in carbon sequestration

- Unit 6: Soil Fertility problems in Nepal:** **8 Hrs.**
- 6.1 Soil fertility status of Nepalese soil
  - 6.2 Soil fertility problems in Nepal
  - 6.3 Effects of continuous use of inorganic and organic nutrient sources on soil
  - 6.4 Soil tillage- structural problems
  - 6.5 Farm mechanization impact on soil properties
  - 6.6 Urbanization, road/link road and land degradation and its consequences

- Unit 7: Sustainable Soil Management:** **10 Hrs.**
- 7.1 Concept of nutrient budget and balanced fertilization
  - 7.2 Integrated nutrient management (INM)
    - 7.2.1 Concept and relevance
    - 7.2.2 Components
    - 7.2.3 Management options
    - 7.2.4 Concept of farmers' field school for INM
  - 7.3 Unsustainability to Sustainability- soil aspects
  - 7.4 Plant Health Clinic
    - 7.4.1 Introduction and relevance
    - 7.4.2 Components and modality to implementation
    - 7.4.3 Soil and plant aspects in Mobile Plant Health Clinic
  - 7.5 Forest and range land
    - 7.5.1 Afforestation
    - 7.5.2 Controlled grazing
    - 7.5.3 Bio-engineering for gulley stabilization

### **Practical**

- Unit 1: Identify tools and instruments used in soil laboratory 2 Hrs.
- Unit 2: Collect and prepare soil samples 2 Hrs.
- Unit 3: Collect and prepare plant samples 2 Hrs.
- Unit 4 and 5: Use kit box for analysis of soil 4 Hrs.

Unit 6: Identify different manures and chemical fertilizers	2 Hrs.
Unit 7 and 8: Collect and identify nutrient deficiency symptoms of plants	4 Hrs.
Unit 9 and 10: Determine organic matter of soil	4 Hrs.
Unit 11 and 12: Estimate available nitrogen in soil	4 Hrs.
Unit 13 and 14: Estimate available phosphorous in soil	4 Hrs.
Unit 15: Estimate available potassium in soil	2 Hrs.

**References:**

1. Brady, N.C., & Weil, R.R. (2015). *The nature and properties of soils* (14<sup>th</sup> ed.). Macmillan Publishing Co., New York.
2. Miller, R.W. & Donahue, R.L. (1995). *Soils: In our environment*. Prentice-Hall, New Jersey.
3. Havlin, J.L., Beaton, J.D., Tisdale, S.L., Nelson, W.L. (2005). *Soil fertility and fertilizes* (7th ed.). Pearson Prentice Hall.
4. Khatri-Chhetri, T.B., & Ojha, R.B. (2016). *An introduction to soils, soil fertility & soil conservation*. Heritage Publishers and Distributors Pvt. Ltd, Bhotahity, Kathmandu, Nepal.

**Final written exam marking scheme**

Unit	1	2	3	4	5	6	7	Total
Unit Hours	5	20	5	5	7	8	10	60
Marks	5	30	5	5	10	10	15	80

## Cereal Crop Production

(AG2202PS)

**Year: II**  
**Semester: II**

**Total: 4 hours /week**  
**Lecture: 2 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the knowledge on botany, physiology, production status and production practices of major cereal crops grown in Nepal.

### Course objectives:

After completion of this course students will be able to:

1. Explain the production status and constraints of cereal farming in Nepal;
2. Explain climatic and nutrient requirement of cereals grown in Nepal;
3. Explain the production practices of cereals grown in Nepal;
4. Perform weed and insect pest management in cereal crops;
5. Grow common and underutilized cereals.

### Course Contents:

#### Theory

- |  |               |
|--|---------------|
| <b>Unit 1: Introduction to Cereal Crops:</b>   | <b>2 Hrs.</b> |
| 1.1. Definition and importance of cereals  |               |
| 1.2. Production status and constraints of cereal crops production in Nepal               |               |
| <b>Unit 2: Rice:</b>   | <b>8 Hrs.</b> |
| 2.1. Rice botany and basic physiology  |               |
| 2.2. Climatic and Edaphic requirement of rice, Rice Varieties in Nepal                   |               |
| 2.3. Nursery management in rice  |               |
| 2.4. Land preparation and transplanting in rice  |               |
| 2.5. Plant Nutrient management in rice; Nitrogen management in rice field                |               |
| 2.6. Weed and water management in rice   |               |
| 2.7. Insect-pest and disease management, Harvesting, Threshing and Storage of rice       |               |
| 2.8. Upland rice, Direct Sown Rice (DSR) and System of Rice Intensification (SRI)        |               |
| <b>Unit 3: Maize:</b>  | <b>6 Hrs.</b> |
| 3.1. Maize botany and basic physiology   |               |
| 3.2. Climatic and Edaphic requirement of maize, Maize Varieties in Nepal                 |               |
| 3.3. Land Preparation, Seed sowing and Plant Nutrient management in maize                |               |
| 3.4. Weed and Irrigation management in maize   |               |
| 3.5. Insect-pest and disease management, Harvesting, Threshing and Storage of maize      |               |
| 3.6. Intercropping, Plant population and Winter maize technology                         |               |
| <b>Unit 4: Wheat:</b>  | <b>6 Hrs.</b> |
| 4.1. Wheat botany and basic physiology   |               |
| 4.2. Climatic and Edaphic requirement of wheat, Wheat Varieties in Nepal                 |               |
| 4.3. Land Preparation, Seed sowing and Plant nutrient management in wheat                |               |
| 4.4. Weed and water management in wheat  |               |
| 4.5. Insect-pest and disease management, Harvesting, Threshing and Storage of wheat      |               |
| 4.6. Zero Till Wheat (ZT- Wheat) and Durum Wheat   |               |
| <b>Unit 5: Finger millet:</b>  | <b>4 Hrs.</b> |
| 5.1. Finger-millet botany and basic physiology   |               |
| 5.2. Climatic and edaphic requirement of finger-millet, finger-millet Varieties in Nepal |               |

- 5.3. Land preparation, nursery management and planting methods in finger-millet  
 5.4. Finger-millet Agronomy

**Unit 6: Buckwheat: 2 Hrs.**

- 6.1. Buckwheat botany, climatic and edaphic requirement of buckwheat, Buckwheat Varieties in Nepal  
 6.2. Buckwheat Agronomy

**Unit 7: Management of under-utilized cereals: 2 Hrs.**

- 7.2. Barley, Naked Barley and Triticale  
 7.3. Minor millets (Foxtail millet, Proso millet, Pearl millet, Sorghum, Grain Amaranth)

**Practical**

Unit 1:	Identify seeds of different cereal crops	1 Hr.
Unit 2:	Study botany of major cereal crops	3 Hrs.
Unit 3:	Practice raising rice nursery by various methods	4 Hrs.
Unit 4:	Prepare field for major cereal crops	3 Hrs.
Unit 5:	Calculate seed requirement in cereals	1 Hr.
Unit 6:	Practice seed treatment in cereals	1 Hr.
Unit 7:	Practice broadcasting, drilling, dibbling and transplanting of cereal crops	4 Hrs.
Unit 8:	Calculate fertilizer requirement in cereals	1 Hr.
Unit 9:	Calculate pesticides required in cereals	1 Hr.
Unit 10:	Observe different types and parts of a sprayer	1 Hr.
Unit 11:	Calibrate sprayer and determine spray volume	1 Hr.
Unit 12:	Practice physical weed management	1 Hr.
Unit 13:	Practice chemical weed management	1 Hr.
Unit 14:	Practice use of granular and dust pesticides	1 Hr.
Unit 15:	Estimate yield of cereal crops	2 Hrs.
Unit 16:	Practice harvesting and threshing of cereals	3 Hrs.
Unit 17:	Practice storage of seeds and grains	1 Hr.

**References:**

1. De Dutta, S. K. (1981). *Principles and practices of rice production*. John Wiley and Sons, New York.
2. Fageria, N.K., Baligar, V.C., & Jones, C.A. (1990). *Growth and mineral nutrition of field crops*. Marcel Dekker, Inc., New York.
3. Reddy, S.R. (2009). *Agronomy of field crops*. Kalyani Publishers, Ludhiana, India.
4. Singh, C., Singh, P., & Singh, R. (2001). *Modern techniques of raising field crops*. Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi, India.
5. Thakur, C. (1979). *Scientific crop production* (Vol.1 & 2). Metropolitan Book Co. Pvt. Ltd., New Delhi, India.
6. Varma, S.C., & Singh, M.P. (1992). *Agronomy of new plant types*. Tara Publications, Varanasi, India.

**Final written exam marking scheme**

Unit	1	2	3	4	5	6	7	Total
Unit Hours	2	8	6	6	4	2	2	30
Marks	5	10	5	5	5	5	5	40

## Plant Pathology and Mushroom Cultivation

(AG2203PS)

**Year: II**  
**Semester: II**

**Total: 4 hours /week**  
**Lecture: 3 hours/week**  
**Tutorial: hour/week**  
**Practical: 2/2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide general idea of plant diseases, and disease causing factors on plant which has significantly reduced the crop yield. It covers the basic concept and definition of pathology and plant pathology, plant pathogens like fungi, bacteria, virus, viroids, nematodes, their disease cycle, infectious and non-infectious diseases, sign and symptoms of diseases. This course provides information on major crop diseases and their diagnostic methods etc. The course also covers plant protection measures like cultural, mechanical, biological, HPR, physical, chemical and IPM. Also, the course provides basic knowledge and skills on different mushroom cultivation practices and their utilization.

### Course objectives:

After completion of this course students will be able to:

1. Identify the diseases causing factors and their characteristics;
2. Identify disease on various crops diseases;
3. Apply pest management practices based on cultural, mechanical, biological, physical, and chemical and IPM techniques;
4. Cultivate different categories of mushroom;
5. Apply control measures for insect, pests and diseases in mushroom.

### Course Contents:

#### Theory

#### Unit 1: Introduction to Plant pathology 3 Hrs.

- 1.1 Definition of Plant pathology and history of Plant Pathology
- 1.2 Importance and scope of plant pathology
- 1.3 General concepts and terminologies in plant pathology Role of plant disease in yield reduction

#### Unit 2: Causes of plant diseases 5 Hrs.

- 2.1 General introduction to Fungus
- 2.2 General introduction to Bacteria
- 2.3 Introduction to virus and nematodes
- 2.4 Diseases caused by abiotic factors
- 2.5 Infectious and non-infectious diseases
- 2.6 General symptoms of plant diseases
- 2.7 Pathogenicity and diseases cycle
- 2.8 Causes and factors affecting disease development
- 2.9 Disease triangle and classification of plant diseases

#### Unit 3: Disease Management methods 5 Hrs.

- 3.1 Physical and mechanical methods
- 3.2 Cultural or Good crop husbandry method
- 3.3 Biological methods and use of resistant varieties

3.4	Chemical method	
3.5	Legislative methods	
3.6	Concept of Integrated Disease Management (IDM)	
<b>Unit 4: Commonly used fungicides and bactericides in Nepal</b>		<b>4 Hrs.</b>
4.1	Types of fungicides and bactericides and their working behavior	
4.2	Formulation of fungicides and bactericides	
4.3	Safe use of fungicides and bactericides	
4.4	Methods of fungicides and bactericides application	
<b>Unit 5: Plant protection equipment</b>		<b>3 Hrs.</b>
5.1	Types of sprayers and dusters	
5.2	Calibration, care and maintenance of sprayers	
5.3	Troubles: cause and remedy	
<b>Unit 6: Crop diseases and their management</b>		<b>10 Hrs.</b>
6.1	Major fungal and bacterial diseases of field crops and their management	
6.2	Major fungal and bacterial diseases of vegetables and their management	
6.3	Major fungal and bacterial diseases of fruits and their management	
6.4	Major diseases caused by virus and nematode and their management	
6.5	Major disease in Ornamentals and Spice crops and their management	
<b>Unit 7: Introduction to mushroom cultivation</b>		<b>3 Hrs.</b>
7.1	Mushroom: Morphology and Importance	
7.2	Scope and Importance of mushroom cultivation	
7.3	Problems and constraints of mushroom cultivation	
7.4	Mushroom poisoning	
<b>Unit 8: Mushroom cultivation practices</b>		<b>10 Hrs.</b>
8.1	Types of cultivated and wild edible mushrooms	
8.2	Mushroom Spawn: Introduction and preparation	
8.3	Common steps in mushroom production	
8.4	cultivation practices of Oyster/ <i>Pleurotus</i> spp mushroom	
8.5	Cultivation practices of Button/ <i>Agaricus bisporus</i> mushroom	
8.6	Cultivation practices of shiitake/ <i>Lentinula edodes</i> mushroom	
<b>Unit 9: Insects pests and diseases of mushroom</b>		<b>2 Hrs.</b>
9.1	Major insects/pests of mushroom and their management	
9.2	Common diseases and their management	
<b>Practical</b>		
Unit 1:	Handle and use of Microscope	1 Hr.
Unit 2:	Collect and preserve diseased parts of plants	1 Hr.
Unit 3:	Identify fungal pathogen from diseased plant parts	1 Hr.
Unit 4:	Prepare common fungal and bacteriological media	1 Hr.
Unit 5:	Identify common fungicides used in Nepal with their label and uses	1 Hr.
Unit 6:	Formulate and apply fungicides	1 Hr.
Unit 7:	Identify different parts and use of knap-sack sprayer	1 Hr.
Unit 8:	Perform foliar application of fungicides	1 Hr.
Unit 9:	Identify different disease symptoms on plants in periphery field	1 Hr.
Unit 10:	Cultivate <i>Pleurotus</i> , <i>Agaricus</i> mushroom	3 Hrs.

**References:**

1. Pokharel, R.R. (2055). *Balibiruwa ka rogharu ra tinko roktham* (2nd edition). Sajha Publishers.
2. Singh, R.S. (1990). *Plant diseases* (6<sup>th</sup> ed.). Oxford and IBH Publishing Co., Ltd., India.
3. Tiwari, K.P. (2012, June). IPM-FFS Institutionalization in Nepal: A Case Study. *The Journal of Agriculture and Environment*, 13.
4. Upadhayaya, N. S. (2002). *Experience of community IPM in Nepal*. Plant Protection Directorate, Department of Agriculture, Harihar Bhawan, Lalitpur, Nepal.
5. Sharma, S.S. (). *Mushroom cultivation in Nepal*
6. Raut, J.K. (2013). *Modern mushroom cultivation technology*. Heritage Publisher & Distributor Pvt. Ltd., Kathmandu, Nepal.
7. Karki, B., & Joshi, P. (2076). *Industrial entomology and mushroom cultivation*. Heritage Publisher & Distributor Pvt. Ltd. Kathmandu, Nepal.

**Final written exam marking scheme**

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

## Vegetable and Spice Crop Production

(AG2204PS)

**Year: II**  
**Semester: II**

**Total: 7 hours /week**  
**Lecture: 5 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide basic knowledge on practices in commercial vegetable and spice production including introduction to olericulture and its related terminologies. The course includes historical development of vegetables and spice farming in Nepal and status of vegetable and spice production in different ecological zones. It covers the importance of vegetable production and consumption, factors determining vegetable production and management aspects of different vegetable and spice crops grown in Nepal.

### Course objectives:

After completion of this course students will be able to:

1. Identify the agro-climatic boon of Nepal for commercial vegetable production;
2. Describe the basic principles of commercial vegetable production;
3. Apply the production techniques of major vegetable crops;
4. Perform home gardening, commercial and off-season marketing techniques;
5. Apply principles and practices of seed production of major vegetable crops.

### Course Contents:

#### Theory

- Unit 1: Introduction of vegetable crops** **3 Hrs.**
- 1.1 Definition of olericulture, vegetable and spices
  - 1.2 History of vegetable development in Nepal
  - 1.3 Organization involved in vegetable development in Nepal
  - 1.4 Status of vegetable production
  - 1.5 Importance and scope of vegetable and spice crop production in Nepal
- Unit 2: Agro-climates for vegetable production** **3 Hrs.**
- 2.1 Agro-ecological zones and micro-climates of Nepal
  - 2.2 Vegetable production during different season in different micro-climates and niche advantages
  - 2.3 Climatic requirement for vegetable and spice production.
- Unit 3: Soil, nutrition and water management in vegetables** **3 Hrs.**
- 3.1 Suitable soils for vegetable and spice production
  - 3.2 Symptoms of nutrient excess and deficiencies and their management in vegetable and spice crop production
  - 3.3 Methods of irrigation in vegetable and spice crops
  - 3.4 Importance of drainage and drainage systems
- Unit 4: Nursery Management for commercial vegetable and spice production** **7 Hrs.**
- 4.1. Definition and importance of nursery
  - 4.2. Types of nursery used (Flat, raised and hot beds) for different vegetable and spices.
  - 4.3. Selection of site and layout preparation for nursery bed.
  - 4.4. Manure application, bed preparation and soil treatment.
  - 4.5. Seed treatment and seed sowing in beds

- 4.6. Common growth media and their use in nursery
- 4.7. Media preparation for plastic and seed tray filling
- 4.8. Seedling rising in plastic bags and seed tray
- 4.9. Construction of nursery tunnel
- 4.10. Intercultural operation (Mulching, weeding, irrigation, fertilizer
- 4.11. Application, plant protection, field sanitation etc.)
- 4.12. Hardening, double transplanting and lifting of seedlings for transplanting

**Unit 5: Home garden** **5 Hrs.**

- 5.1 Importance and scope of home garden and roof top farming
- 5.2 Characteristics of home garden kitchen garden, roof top farming
- 5.3 Component of home garden, kitchen garden, roof top farming
- 5.4 Materials and equipment used for roof top farming (Pots, growth media, staking, materials used for plant protection and other equipment)
- 5.5 Layout preparation for home gardening.
- 5.6 Site selection and design of home and roof-top garden
- 5.7 Crop selection for each type (leafy, root, fruit, and legume and Cole crops)
- 5.8 Crop calendar of vegetable and fruits production for year round supply in home garden.

**Unit 6: Cultivation Practices of major vegetables and spices.** **23 Hrs.**

- 6.1 Origin, nutritional value, climate and soil requirements, varieties, planting material (seed /seedling) management, land preparation, manure and fertilization application, sowing/transplanting, irrigation, intercultural practices, integrated crop/insect pest and disease management, harvesting, post-harvest handling, and yield and storage of:
  - 6.1.1 Solanaceous vegetable crops-tomato, chilies, sweet pepper and eggplant
  - 6.1.2 Cole crops- cauliflower, cabbage, broccoli and kno-khol
  - 6.1.3 Cucurbitaceous crops- cucumber, sponge and ridge gourd, bitter gourd, pointed gourd and bottle gourd and watermelon
  - 6.1.4 Tuber and bulb crops - potato, onion and garlic
  - 6.1.5 Leafy vegetable crops- broad leaf mustard, spinach, cress, lettuce, coriander and Swiss chard
  - 6.1.6 Root crops- radish, turnip, carrot and beetroot
  - 6.1.7 Legume crops- beans, peas and cowpeas
  - 6.1.8 Asparagus and okra
  - 6.1.9 Ginger, turmeric and cardamom
  - 6.1.10 Major spices- Cumin, coriander, fenugreek
- 6.2 Special additional activities in case of spice crops
- 6.3 Innovative technologies

**Unit7 Off-season vegetable productions** **3 Hrs.**

- 7.1 Concept of seasonal and off-seasonal production
- 7.2 Principles and techniques of off-season production
- 7.3 Advantages and disadvantages of off-season production over seasonal production

**Unit 8 Vegetable production under protective structure.** **13 Hrs.**

- 8.1 Introduction, advantage and disadvantage of protective vegetable production.
- 8.2 Types of protective structures (Greenhouse, polyhouse, shade houses, rain shelters and net houses)
- 8.3 Designing protected structures
- 8.4 Environmental control and management: Control, management and manipulation of temperature, light, humidity, air and CO<sub>2</sub>; heating and cooling systems,

- ventilation, naturally ventilated greenhouses, fan and pad cooled greenhouses, light regulation
- 8.5 Method of plastic house/protected structures construction for different agroecological zones
- 8.6 Cultivation of major vegetables (Tomato, cucurbits, sweet peeper etc.) inside protective structures
- 8.7 Common environmental and biological problem seen in plastic house cultivation and their management.

**Unit 9 Organic vegetable production 5 Hrs.**

- 9.1 Importance, scope, status and history of organic vegetable production its constraint and opportunities
- 9.2 Government policy and strategies for organic agriculture
- 9.3 Guiding principles and standards of organic agriculture
- 9.4 Certification system of organic vegetables in Nepal
- 9.5 Good Agriculture Practice (GAP) for vegetable production

**Unit 10 Vegetable seed production 10 Hrs.**

- 10.1 Describe the importance and status of vegetable seed production in Nepal
- 10.2 Classify vegetables based on pollination behavior with examples
- 10.3 Definition of Isolation distance, field inspection, rouging, seed quality criteria etc.
- 10.4 Describe seed production techniques of the major vegetable crops (Potato, radish, carrot, bean, peas, cauliflower, tomato, cucumber and onion)

**Practical**

- Unit 1: Identify vegetable crop's seed and write their scientific names 2 Hrs.
- Unit 2: Identify vegetable crop plants, edible parts and record their morphology 2 Hrs.
- Unit 3: Identify spice crops and their planting parts and record their morphology 2 Hrs.
- Unit 4: Practice soil solarization 2 Hrs.
- Unit 5: Prepare nursery bed for major vegetable 2 Hrs.
- Unit 6: Prepare poly pot filling media and sow cucurbits in plastic pots 2 Hrs.
- Unit 7: Preparation field for sowing/ transplanting of seasonal vegetables 2 Hrs.
- Unit 8: Design and layout preparation for home gardening 2 Hrs.
- Unit 9: Prepare hotbeds for winter season nursery 2 Hrs.
- Unit 10: Practice urea top-dressing in seasonal vegetables and weeding 2 Hrs.
- Unit 11: Draw a layout design and prepare 6 meter by 10 meter plastic house 2 Hrs.
- Unit 12: Construct of plastic nursery tunnel for seedling raising 2 Hrs.
- Unit 13: Practice of intercultural operation (weeding, hoeing, mulching, staking, earthing up, training, pruning, removing old and diseased leaves) 2 Hrs.
- Unit 14: Practice of 3G cutting in vegetable 2 Hrs.
- Unit 15: Practice of cleaning, trimming, cooling, pre-cooling, grading, packaging, transportation, storage etc. 2 Hrs.

**Final written exam marking scheme**

Unit	1	2	3	4	5	6	7	8	9	10	Total
Unit Hours	3	3	3	7	5	23	3	13	5	10	75
Marks	5	5	5	5 or 10	5	25	5	10 or 15	5	10	80

## Fundamentals of Aquaculture and Fisheries

(AG2205PS)

**Year: II**  
**Semester: II**

**Total: 5 hours /week**  
**Lecture: 3 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

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

### Course objectives:

After completion of this course students will be able to:

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

### Course Contents:

#### Theory

#### Unit 1: Introduction to Fisheries:

**7 Hrs.**

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

#### Unit 2: Pond, cage and pond fish culture:

**10 Hrs.**

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

#### Unit 3: Water quality and pond management:

**10 Hrs.**

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

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

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

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

- 5.1 Common fish parasites and diseases in Nepal
  - 5.1.1 Causes and etiology
  - 5.1.2 Symptoms and species affected
  - 5.1.3 Types of fish disease, infectious and non-infectious
- 5.2 Protozoan fish disease, causal organism, symptom and control measures
- 5.3 Fungal fish disease, causal organism, symptom and control measures
- 5.4 Bacterial fish disease, causal organism, symptom and control measures
- 5.5 Worm and crustacean fish disease, causal organism, symptom and control measures
- 5.6 Non-infectious disease caused by water quality, nutritional and control measures

**Practical**

- Unit 1: Identify external and internal body parts of fish 2 Hrs.
- Unit 2: Collect and identify fishes of Nepal of least 4 orders 4 Hrs.
- Unit 3: Identify of cultivated exotic and indigenous fish species 3 Hrs.
- Unit 4: Collect water sample 2 Hrs.
- Unit 5: Record water temperature and pH 2 Hrs.
- Unit 6: Record dissolved oxygen and turbidity 2 Hrs.
- Unit 7: Collect and identify planktons 2 Hrs.
- Unit 8: Fertilize/manure fish pond 2 Hrs.
- Unit 9: Identify aquatic weeds and predatory fish 2 Hrs.
- Unit 10: Formulate fish ration 2 Hrs.
- Unit 11: Identify brood fish and breeding equipment 2 Hrs.
- Unit 12: Extract the pituitary gland of fish 2 Hrs.
- Unit 13: Collect/identify/control common parasites of fish 3 Hrs.

**References:**

1. Shrestha, M.K., Pandit, N.P. (2007). *Principles of aquaculture* (2<sup>nd</sup> ed.). Department of Aquaculture, Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal.
2. Augusty, K.T. (1979). *Fish farming in Nepal*. Archana Printers & Publisher, Kottayam 29, India.
3. Brown, E.E. & Gratzek, J.B. (1992, June). *Fish farming hand book*. Van Nostrand Reinhold company, New York. doi.org/10.1002/rrr.3450070212
4. Shrestha, T.K., & Jha, D.K. (1993). *Introduction to fish culture*. Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal.
5. Woynarovich, E. (1975). *Elementary guide to fish culture in Nepal*. Food and Agriculture Organization of the United Nations, Rome.

**Final written exam marking scheme**

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

## Agri-Economics and Farm Management

(AG2206PS)

**Year: II**  
**Semester: II**

**Total: 6 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the knowledge on basic economics and farm management skills based on economic principles. The entire course deals with explaining the introduction, importance, assumptions and limitations of economics. The course deals with concerns of consumers' behavior, cost concepts and market types. Similarly, in the part of Farm Management, the course covers introduction, importance and problems of farm management in Nepal. It deals with production relationships and principals involved in farm management decisions. The course also covers the aspects of farm planning, farm budgeting, farm inventory and records keeping, farm efficiency measures and farm business.

### Course objectives:

After completion of this course students will be able to:

1. Describe the general concept and principle of economics particularly in relation to production, marketing, distribution and consumption;
2. Draw the profit maximization condition under various production relationships;
3. Prepare an effective farm plan and farm budget;
4. Prepare and maintain farm records;
5. Analyze farm efficiency;
6. Locate risks and risk mitigating strategies in agriculture.

### Course Contents:

#### Theory

#### Unit 1: Introduction to Economics: 4 Hrs.

- 1.1. General definition and assumptions of Economics
- 1.2. Definition of economics given by Adam Smith, Characteristics, Criticism
- 1.3. Marshall's welfare definition of economics, Characteristics, Criticism
- 1.4. Robin's Scarcity definition of economics, Characteristics, criticism
- 1.5. Comparison between Marshall and Robin's definition of Economics
- 1.6. Importance, Subject matter and Limitation of Economics

#### Unit 2: Basic concepts of Economics: 2 Hrs.

- 2.1. Concept of goods, utility, value, price, wealth, production, consumption, equilibrium and margin

#### Unit 3: Consumer's Behavior: 3 Hrs.

- 3.3. Concept and assumptions of ordinal and cardinal approach of utility measurement
- 3.4. Concept, assumption, explanation and exceptions of law of diminishing marginal utility
- 3.5. Indifference curve and its properties.
- 3.6. Concept of price line/budget line, marginal rate of substitution, consumers

#### Unit 4: Demand and Law of Demand: 3 Hrs.

- 4.1. Definition and determinants of demand

- 4.2 Law of demand (concept, explanation and exceptions)
- 4.3 Movement and shift in demand curve
- 4.4 Elasticity of demand and its types
- 4.5 Definition and concept of price elasticity, income elasticity and cross elasticity of demand

**Unit 5: Demand and Law of Supply: 2 Hrs.**

- 5.1 Definition and determinants of supply
- 5.2 Law of supply (concept, explanation and exceptions)
- 5.3 Movement and shift in supply curve
- 5.4 Concept of elasticity of supply and its types

**Unit 6: Concept of Cost and Revenue 3 Hrs.**

- 6.1 Cost and its types
- 6.2 Concept of various long run and short run cost curve
- 6.3 Relation between average cost and marginal cost, average variable cost and marginal cost, Short run and long run cost curve
- 6.4 Concept of Revenue
- 6.5 Concept of Average revenue, marginal revenue and their relationship
- 6.6 Uses of cost and revenue concept

**Unit 7: Market and its types 4 Hrs.**

- 7.1 Definition of market and classification of market on basis of competition.
- 7.2 Concept of perfect competitive market (Definition, characteristics, price and output determination)
- 7.3 Concept of monopoly market (Definition, characteristics, price and output determination)
- 7.4 Concept of monopolistic market (Definition and characteristics)

**Unit 8: Factors of Production 3 Hrs.**

- 8.1 Land (Definition and characteristics), Rent (Definition and types) and Quasi-rent
- 8.2 Labour (Definition and characteristics) and Wage (Definition and types)
- 8.3 Capital (Definition, characteristics and types) and Interest (Definition and types)
- 8.4 Organization (Definition and characteristics) and Profit (Definition and types)

**Unit 9: Introduction to Farm Management 3 Hrs.**

- 9.1 Concept of farm management
- 9.2 Nature/ Characteristics of farm management
- 9.3 Scope of farm management
- 9.4 Importance of farm management
- 9.5 Problem related to farm management

**Unit 10: Management of farm resources 2 Hrs.**

- 10.1 Concept of land, labour, mechanization, farm layout
- 10.2 Interrelationship between various component of farming system

**Unit 11: Input-Input Relationship (Factor-Factor Relationship) 3 Hrs.**

- 11.1 Concept of isoquant, iso-cost line, marginal rate of technical substitution, price ratio, isocline, ridge line and expansion path.
- 11.2 Substitution in factor-factor relationship (Fixed Proportion Combination, increasing rate, Decreasing rate and Constant Rate of Substitution)

- 11.3 Characteristics of isoquant
- 11.4 Least cost combination and different methods of calculating least cost combination
- Unit 12: Output-Output Relationship (Product-Product Relationship) 3 Hrs.**
- 12.1 Concept of production possibility curve (PPC), iso-revenue line, marginal rate of product substitution
- 12.2 Types of product-product relationship (joint product, complementary product, supplementary product, competitive product and antagonistic product)
- 12.3 Profit maximization under output-output relationship
- Unit 13: Input-Output Relationship (Factor-Product Relationship) 4 Hrs.**
- 13.1 Concept of input-output relationship and production function
- 13.2 Law of return
- 13.3 Three regions of production function
- 13.4 Relation between TP and MP, AP and MP
- Unit 14: Principles Involved in Farm management decision 6 Hrs.**
- 14.1 Principle of diminishing return
- 14.2 Cost principle
- 14.3 Principle of factor substitution
- 14.4 Principle of combining enterprises
- 14.5 Principle of equi-marginal return
- 14.6 Principle of comparative advantage
- 14.7 Principle of time comparison
- 14.8 Opportunity cost principle
- Unit 15: Farm Planning and budgeting 5 Hrs.**
- 15.1 Definition, types and characteristics of good farm planning
- 15.2 Definition of farm budgeting
- 15.3 Brief concept about types of farm budgeting (complete, partial and enterprise budgeting)
- 15.4 Steps in farm planning and budgeting
- Unit 16: Farm Record Keeping and Depreciation 4 Hrs.**
- 16.1 Brief Concept of Balance Sheet, Income Statement and Cash Flow Statement
- 16.2 Definition of farm inventory and process of taking farm inventory
- 16.3 Concept of depreciation and methods of calculating depreciation
- Unit 17: Farm Efficiency Measure 4 Hrs.**
- 17.1 Concept of farm efficiency
- 17.2 Measuring farm efficiency (physical efficiency and financial efficiency)
- Unit 18: Risk and Uncertainty 2 Hrs.**
- 18.1 Concept of risk and uncertainty
- 18.2 Types of risk and uncertainty in Nepalese agriculture
- 18.3 Management of risk and uncertainty in farm

### Practical

Unit 1: Calculate least cost combination	2 Hrs.
Unit 2: Calculate optimum product combination	2 Hrs.
Unit 3: Categorize three regions of production function	2 Hrs.
Unit 4: Prepare enterprise and partial budget	4 Hrs.
Unit 5: Prepare income statement and balance sheet	4 Hrs.
Unit 6: Calculate depreciation of farm assets	2 Hrs.
Unit 7: Calculate farm efficiency	3 Hrs.
Unit 8: Prepare farm inventory	3 Hrs.
Unit 9: Locate agriculture risk and mitigation practices adopted by farmers	3 Hrs.
Unit 10: Report farming practices and system adopted by farmers	3 Hrs.
Unit 11: Compare of time value of money	2 Hrs.

### References:

1. Chopra, P.N. (2000). *Principle of economics*. Kalyani Publishers, New Delhi.
2. McConnel, C.R. (1975). *Economics: Principles, problems and policies*. McGraw-Hill, USA.
3. Johl, S. S., & Kapoor, T. R. (1973). *Fundamentals of farm business management*. Kalyani Publishers, New Delhi.
4. Kay, R.D., & Edwards, W. M. (1994). *Farm management*. McGraw Hill, Inc., New Delhi.
5. Shankhyan, P. L. (1983). *Introduction to farm management*. Tata, McGraw-Hill, Co. Ltd., New Delhi.

### Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Unit Hours	4	2	3	3	2	3	4	3	3	2	3	3	4	6	5	4	4	2	60
Marks	5	5	5	5	5	5	5	5	5	5	5	5	5	10	5	5	5	5	80

## Industrial Crops

(AG2207PS)

**Year: II**  
**Semester: II**

**Total: 5 hours /week**  
**Lecture: 3 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the theoretical as well as practical knowledge to the students in agronomy of industrial crops such as sugarcane, cotton, tobacco, jute, tea, coffee and cardamom with respect to the importance and uses, distribution, area of production, origin, climate, soil, varieties, land preparation, manure and fertilizers, seed treatment, time and method of sowing, irrigation, weeding training pruning, insect pest, disease, harvesting, yield, processing, economic profit and storage including marketing.

### Course objectives:

After completion of this course students will be able to:

1. Describe the status, importance and scope of the industrial crops in respect to national and global distribution;
2. Explain climatic and nutrient requirement of industrial crops grown in Nepal;
3. Explain the production practices of industrial crops grown in Nepal;
4. Perform fertilization, weed and insect pest management in industrial crops of Nepal;
5. Perform processing of industrial crops grown in Nepal.

### Course Contents:

#### Theory

<b>Unit 1: Introduction to Industrial crops:</b>	<b>5 Hrs.</b>
1.1. Definition of commercial and industrial crops	
1.2. Importance and scope of industrial crops	
1.3. Global and national distribution of industrial crops	
<b>Unit 2: Cultivation practices of sugarcane</b>	<b>10 Hrs.</b>
2.1 Introduction and economic uses (products and byproducts)	
2.2 Botany and types of sugarcane	
2.3 Climate and soil requirement of Sugarcane; Varieties of sugarcane in Nepal	
2.4 Planting materials and preparation of planting materials	
2.5 Methods of planting in sugarcane and land preparation for them	
2.6 Manure and fertilizers management	
2.7 Irrigation and weed management	
2.8 Insects, pests and diseases and their control measures	
2.9 Harvesting and yield	
2.10 Sugarcane ratoon management	
<b>Unit 3: Cultivation practices of jute</b>	<b>6 Hrs.</b>
3.1 Introduction and economic uses	
3.2 Climate and soil requirement and varieties	
3.3 Land preparation and Sowing of Jute	
3.4 Manure and fertilizers management and interculture	
3.5 Insects, pests and diseases and their control measures	

- 3.6 Harvesting and retting
- 3.7 Jute fiber

**Unit 4: Cultivation practices of tea** **8 Hrs.**

- 4.1 Introduction and economic uses
- 4.2 Climate and soil requirement; Varieties
- 4.3 Propagation and nursery management
- 4.4 Planting of tea
- 4.5 Manure and fertilizers management
- 4.6 Training, pruning and garden management
- 4.7 Irrigation and weeding management
- 4.8 Insects, pests and diseases and their control measures
- 4.9 Harvesting and storage
- 4.10 Processing and marketing
- 4.11 Organic Tea Production

**Unit 5: Cultivation practices of Coffee** **8 Hrs.**

- 5.1 Introduction and economic uses
- 5.2 Climate and soil requirement; Varieties
- 5.3 Propagation and nursery management
- 5.4 Planting of coffee
- 5.5 Manure and fertilizers management
- 5.6 Training, pruning and garden management
- 5.7 Irrigation and weeding management
- 5.8 Insects, pests and diseases and their control measures
- 5.9 Harvesting, and storage
- 5.10 Processing and marketing
- 5.11 Organic Coffee Production

**Unit 6: Cultivation practices of Cardamom** **8 Hrs.**

- 6.1 Introduction and economic uses
- 6.2 Climate and soil requirement; Varieties
- 6.3 Propagation and nursery management
- 6.4 Planting
- 6.5 Manure and fertilizers management
- 6.6 Pre-harvest intercultural in Cardamom
- 6.7 Insects, pests and diseases and their control measures
- 6.8 Harvesting, processing and storage
- 6.9 Organic cardamom production

**Practical**

- Unit 1: Identification of industrial crops and their seeds 2 Hrs.
- Unit 2: Calculation and application of chemical fertilizers 4 Hrs.
- Unit 3: Calculation of seed rate 2 Hrs.
- Unit 4: Identification and application of suitable method of weed control 2 Hrs.
- Unit 5: Formulation and spraying of pesticides 3 Hrs.
- Unit 6: Cultivation practices of sugarcane or jute 5 Hrs.
- Unit 7: Cultivation practices of tea or coffee 4 Hrs.
- Unit 8: Perform processing of tea or coffee 4 Hrs.
- Unit 9: Planting, harvesting, drying and storage of Cardamom 4 Hrs.

**References:**

1. Reddy, S.R. (2009). *Agronomy of field crops*. Kalyani Publishers, Ludhiana, India.
2. Singh, C., Singh, P., & Singh, R. (2001). *Modern techniques of raising field crops*. Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi, India.
3. Singh, S.S. (1988). *Crop Management Under Irrigated and rainfed conditions*. Kalyani Publisher, New Delhi, India.
4. Bhattachan, B.K., & Devkota, K.H. *An Introduction to Agronomy (in Nepali language)*.
5. Annual Report of National Sugarcane Research Program Jitpur, National Jute Research Program Belachapi and Tea Production Company Illam, and National coffee research program Gulmi Nepal.

**Final written exam marking scheme**

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

**Third Year/ First Semester**

## Medicinal Plants and NTFP

(AG3101PS)

**Year: III**  
**Semester: I**

**Total: 4 hours /week**  
**Lecture: 2 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the knowledge about the need of promoting medicinal plants and other non-timber forest products highlighting the importance and prospects in Nepalese scenario and major hindrances in its cultivation and marketing. The course includes classification of NTFPs and medicinal plants, status of trade and marketing of NTFPs, processing and post-harvest technology as well as package of practices and uses of high valued NTFP and medicinal plants.

### Course objectives:

After completion of this course students will be able to:

1. Describe the scope, prospects, history, classification and constraints of medicinal plants cultivation;
2. Evaluate the status of trade and marketing of NTFP and medicinal plants along with its processing and post-harvest technologies in Nepal
3. Practice the cultivation of major NTFP and medicinal plants;
4. Analyze the use of traditional knowledge related to medicinal plants and explore the phytochemicals present in selected plants.

### Course Contents:

#### Theory

#### Unit 1: Introduction to medicinal plants and NTFP: 3 Hrs.

- 1.1. Definition to key terms; history and development of herbal science in Nepal and abroad; introduction to basic concepts of folk medicine and Ayurveda, Naturopathy and Yoga
- 1.2. Importance, scope, prospects of medicinal plants/NTFP and constraints to production
- 1.3. Classification of NTFP (based on origin) and medicinal plants (according to therapeutic use, growth habit and parts used)

#### Unit 2: Trade and marketing of NTFP and medicinal plants: 5 Hrs.

- 2.1. Current trend of trade of NTFP and medicinal plants in Nepal and world
- 2.2. Prioritized NTFP for trade and the criteria set for prioritization
- 2.3. Marketing channels of NTFP and medicinal plants in Nepal; Constraints to marketing of medicinal plants in Nepal
- 2.4. Legal provisions regulating the trade and marketing of NTFP in Nepal
- 2.5. Role of NTFP and medicinal plants in rural economy; need of research and development in medicinal plants sector

#### Unit 3: Processing and post-harvest technology of medicinal plants and NTFP:5 Hrs.

- 3.1. Collection/harvesting, washing, drying, garbling, packaging and storage of NTFP and medicinal plants

- 3.2. Introduction to primary and secondary metabolites; types of secondary metabolites
- 3.3. Preparation of herbal infusions, decoctions, lotions, suppositories, tinctures, syrups, poultices, plasters, ointments, oils and salves
- 3.4. Traditional processing of NTFP by ethnic groups; the enabling environment for successful NTFP processing
- 3.5. Value addition and enterprise development of NTFP

**Unit 4: Cultivation practices of major NTFP and medicinal plants: 15 Hrs.**

- 4.1. Environment (Climate and soil), cultivation, harvesting and use of:
  - 4.1.1. *Elettaria cardamomum*, *Emblica officinalis* and *Thysanolaena maxima*
  - 4.1.2. *Justicia adhatoda*, *Tinospora cordifolia* and *Swertia chirayita*
  - 4.1.3. *Azadirachta indica*, *Taxus wallichiana* and *Sapindus mukorossi*
  - 4.1.4. *Juglans regia*, *Chrysopogon zizanioides* and *Asparagus racemosus*
  - 4.1.5. *Acorus calamus*, *Crocus sativus* and *Picrorhiza kurroa*
  - 4.1.6. *Rheum nobile*, *Aloe vera* and *Plantago ovate*
  - 4.1.7. *Cinnamomum verum*, *Cinnamomum glaucescens*, *Zanthoxylum armatum* and *Zanthoxylum piperitum*
  - 4.1.8. *Rauvolfia serpentina*, *Bergenia ligulata* and *Piper longum*
  - 4.1.9. *Salvia rosmarinus*, *Mentha arvensis* and *Acacia concinna*
  - 4.1.10. *Ophiocordyceps sinensis*, *Morchella esculenta* and *Ganoderma lingzhi*
  - 4.1.11. Medicinal yam (*Dioscorea composita* and *D. floribunda*) and *Aconitum heterophyllum*
  - 4.1.12. *Asanda butyracea*, *Cassia fistula* and *Santalum album*
  - 4.1.13. *Ricinus communis*, *Cymbopogon citratus* and *Mucuna purita*
  - 4.1.14. *Valeriana jatamansi*, *Rhododendron arboreum* and *Curcuma angustifolia*
  - 4.1.15. *Saussurea gossypiphora*, *Eritrichium canum* and *Terminalia chebula*

**Unit 5: Documentation and use of traditional botanical knowledge 2 Hrs.**

- 5.1. Need of documentation; process of documentation of ethnobotanical knowledge
- 5.2. Issues related to bioprospecting and bio piracy of medicinal plants and measures to overcome it.

**Practical**

- Unit 1: Study of medicinally important families (diagnostic features with at least three examples of species of medicinal use): Papaveraceae, Rutaceae, Fabaceae, Apiaceae, Rubiaceae, Asteraceae, Solanaceae, Scrophulariaceae, Lamiaceae, Liliaceae. 2 Hrs.
- Unit 2: Conduct field visit to identify different medicinal, aromatic and non-timber forest plants 3 Hrs.
- Unit 3: Prepare of herbarium specimens of at least fifteen medicinal plants and NTFP studied in theory 2 Hrs.
- Unit 4: Perform nursery preparation and sowing of seeds and plants 2 Hrs.
- Unit 5: Propagate grasses, shrubs and trees type of high valued medicinal plants and NTFP by asexual methods 3 Hrs.
- Unit 6: Perform harvesting and drying in the medicinal plants and NTFP 2 Hrs.
- Unit 7: Perform packaging, storage and marketing of medicinal plants and NTFP 2 Hrs.
- Unit 8: Observe the extraction process of essential oil or other products in a local processing plant/industry 3 Hrs.
- Unit 9: Study organoleptic parameters of some plants prescribed in the syllabus 2 Hrs.
- Unit 10: Prepare herbal formulations of medicinal plants 2 Hrs.

Unit 11: Perform qualitative screening of alkaloids, flavonoids, saponins, terpenoids, saponins, proteins, and carbohydrates in medicinal plants samples	4 Hrs.
Unit 12: Use of medicinal plants in preparation of various botanicals	3 Hrs.

**References:**

1. Baral, S.R. & Kurmi, P.P. (2006). *A compendium of medicinal plants of Nepal*. Mrs. Rachana Sharma, Chabahil, Kathmandu, Nepal.
2. Bhattacharjee, S.K. (2004). *Handbook of medicinal plants* (4<sup>th</sup> ed.). Jaipur Publishing house, India.
3. Gurung, K. (2009). *Essential oil in Nepal: A practical guide to essential oil and aromatherapy*. Himalayan Bio-trade Pvt. Ltd., Kathmandu, Nepal.
4. IUCN, (2000). National Register of Medicinal Plants. *IUCN-Nepal*, Kathmandu, Nepal.
5. Joshi, K.K. & Joshi, S.D. (2006). *Medicinal and aromatic plants used in Nepal, Tibet and trans-Himalayan region*. Author House Publication, UK.
6. Manandhar, N.P. (1980). *Medicinal plants of Nepal Himalaya*. Ratna Pustak Bhandar, Kathmandu, Nepal.
7. Prajapati, N.S., Purohit, S.S., Sharma, A.K., & Kumar, T. (2003). *A handbook of medicinal plants*. Agro-bios, India.
8. Rao, A.P. (1999). *Herbs that heal*. Diamond Pocket Books Pvt. Ltd., New Delhi, India.
9. Sharma, R. (2004). *Agro-techniques of medicinal plants*. Daya Publishing House, Delhi, India.
10. Watanabe, T., Raj Bhandari, K.K., Malla, K.J., & Yahara, S. (2005). *A handbook of medicinal plants of Nepal*. Kobfa Publishing Project, Bangkok, Thailand.

**Final written exam marking scheme**

Unit	1	2	3	4	5	Total
Unit Hours	3	5	5	15	2	30
Marks	5	5	5	20	5	40

## Grain Legumes and Oilseed Crops

(AG3102PS)

**Year: III**  
**Semester: I**

**Total: 4 hours /week**  
**Lecture: 2 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the knowledge on botany, physiology, production status and production practices of grain legumes and oilseed crops grown in Nepal.

### Course objectives:

After completion of this course students will be able to:

1. Explain the botany and taxonomy of grain legumes and oilseed crops grown in Nepal;
2. Explain the production status and importance of grain legumes and oilseed farming in Nepal;
3. Explain climatic and nutrient requirement of grain legumes and oilseed grown in Nepal;
4. Explain the production practices of grain legumes and oilseed grown in Nepal;
5. Perform weed and insect pest management in grain legumes and oilseed crops;

### Course Contents:

#### Theory

**Unit 1: Introduction to grain legumes: 3 Hrs.**

- 1.1. Definition and terminologies
- 1.2. Biological nitrogen fixation
- 1.3. Importance of grain legumes, Status and Constraints of grain legumes in Nepal

**Unit 2: Winter grain legumes (With reference to Lentil and Chickpea): 3 Hrs.**

- 2.1 Botany and phenology
- 2.2 Climatic and Edaphic requirement of winter legumes, Varieties of winter legumes in Nepal
- 2.3 Winter legumes Agronomy

**Unit 3: Summer grain legumes (With reference to Black gram and Mung bean): 3Hrs.**

- 3.1 Botany and Phenology
- 3.2 Climatic and Edaphic requirement of summer legumes, Varieties of summer legumes in Nepal
- 3.3 Summer legumes Agronomy

**Unit 4: Rainy season grain legumes (With reference to Kidney bean and Pigeon pea): 3 Hrs.**

- 4.1 Botany and Phenology
- 4.2 Climatic and Edaphic requirement of rainy season grain legumes, Varieties of the crops in Nepal
- 4.3 Agronomy of rainy season grain legumes

**Unit 5: Introduction to oilseed crops: 2 Hrs.**

- 5.1 Definition and terminologies
- 5.2 Importance, Status and Constraints of oilseed crops in Nepal

**Unit 6: Rapeseed and Mustard: 3 Hrs.**

- 6.1. Botany and Phenology
- 6.2. Climatic and Edaphic requirement, Varieties of rapeseed and mustard in Nepal
- 6.3. Agronomy of rapeseed and mustard

**Unit 7: Soybean 3 Hrs.**

- 7.1 Botany and Phenology

7.2	Climatic and Edaphic requirement, Varieties of soybean in Nepal	
7.3	Agronomy of soybean	
<b>Unit 8: Groundnut</b>		<b>3 Hrs.</b>
8.1	Botany and Phenology	
8.2	Climatic and Edaphic requirement, Varieties of groundnut in Nepal	
8.3	Agronomy of groundnut	
<b>Unit 9: Sunflower</b>		<b>3 Hrs.</b>
9.1	Botany and Phenology	
9.2	Climatic and Edaphic requirement, Varieties of sunflower in Nepal	
9.3	Agronomy of sunflower	
<b>Unit 10: Agronomy of other grain legumes and oilseed crops</b>		<b>4 Hrs.</b>
10.1.	Cowpea	
10.2.	Rice bean	
10.3.	Sesame	
10.4.	Safflower	
10.5.	Niger	
10.6.	Castor	

### Practical

Unit 1:	Identify seeds and plants of grain legumes and oilseed crops	2 Hrs.
Unit 2:	Practice seed priming in legumes	2 Hrs.
Unit 3:	Practice rhizobium inoculation in grain legumes	2 Hrs.
Unit 4:	Practice planting grain legume crops	2 Hrs.
Unit 5:	Practice planting oilseed crops	2 Hrs.
Unit 6:	Practice thinning and gap filling in grain legumes and/or oilseed crops	2 Hrs.
Unit 7:	Practice weeding in grain legumes and/or oilseed crops	2 Hrs.
Unit 8:	Identify weeds in grain legumes and oilseed crops	2 Hrs.
Unit 9:	Practice nipping in grain legumes	2 Hrs.
Unit 10:	Observe root nodule formation in grain legumes	2 Hrs.
Unit 11:	Identify maturity indices of grain legumes and oilseed crops	2 Hrs.
Unit 12:	Estimate yield of grain legumes and oilseed crops	3 Hrs.
Unit 13:	Practice harvesting and threshing grain legumes and oilseed crops	3 Hrs.
Unit 14:	Visit an organization to identify and observe research and demonstrations related to grain legumes and oilseed crops.	2 Hrs.

### References:

1. De Dutta, S. K. (1981). Principles and practices of rice production. John Wiley and Sons, New York.
2. Fageria, N.K., Baligar, V.C., & Jones, C.A. (1990). Growth and mineral nutrition of field crops. Marcel Dekker, Inc., New York.
3. Reddy, S.R. (2009). Agronomy of field crops. Kalyani Publishers, Ludhiana, India.
4. Singh, C., Singh, P., & Singh, R. (2001). Modern techniques of raising field crops. Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi, India.
5. Thakur, C. (1979). Scientific crop production (Vol. 1 & 2). Metropolitan Book Co. Pvt. Ltd., New Delhi, India.
6. Varma, S.C., & Singh, M.P. (1992). Agronomy of new plant types. Tara Publications, Varanasi, India.

### Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	Total
Unit Hours	3	3	3	3	2	3	3	3	3	4	30
Marks	15			5		15			5		40

## **Fruit Crop Production**

(AG3103PS)

**Year: III**  
**Semester: I**

**Total: 6 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### **Course description:**

This course is designed to provide the knowledge and skills on importance, feasibility and niches for cultivation of fruit and plantation crops in Nepal including classification of fruit crops, influence of environmental factors on fruit crops, orchard establishment, basic orchard management practices, cultivation practices of major fruit crops of Nepal.

### **Course objectives:**

After completion of this course students will be able to:

1. Describe about feasibility and niches for cultivation of fruit crops in Nepal;
2. Classify fruit crops;
3. Describe effects of different environmental factors on fruit crops;
4. Plan, organize and establish an orchard;
5. Perform orchard management practices.

### **Course Contents:**

#### **Theory**

#### **Unit 1: Introduction to the fruit crop production**

**5 Hrs.**

- 1.1. Importance of fruit crops
- 1.2. Potentialities and constraints of fruit crops in Nepal
- 1.3. Ecological regions and niches of fruit crop production in Nepal
- 1.4. Classification of fruit crops grown in different agro climatic zone in Nepal
- 1.5. Classification of fruit crops

#### **Unit 2: Plant propagation and nursery establishment**

**15 Hrs.**

- 2.1 Sexual and asexual method of propagation: Introduction, comparative study, advantages of asexual propagation over sexual propagation.
- 2.2 Method of Sexual and asexual propagation: seed, vegetative parts, cutting, layering, grafting, budding, tissue culture etc.
- 2.3 Nursery raising techniques for sapling production via seed.
- 2.4 Nursery raising techniques for sapling production via cutting, grafting, budding etc.
- 2.5 Protective structure for fruit nursery establishment
- 2.6 Bud wood certification system for citrus nursery

#### **Unit 3: Orchard establishment**

**18 Hrs.**

- 3.1 Describe different factors to be considered to select the site for the establishment of orchard
  - 3.1.1 Climate and weather
  - 3.1.2 Soil and land slope
  - 3.1.3 Irrigation and drainage facility
- 3.2 Lay-out preparation for orchard establishment
  - 3.2.1 Square system
  - 3.2.2 Rectangular system

- 3.2.3 Hexagonal system (Triangular system)
- 3.2.4 Contour system
- 3.2.5 High density planting
- 3.3 Windbreak and shelter belt
- 3.4 Selection of fruit crop and variety
- 3.5 Planting season
- 3.6 Planting of fruit sapling
- 3.7 Pit digging, pit filling
- 3.8 Staking
- 3.9 Mulching
- 3.10 Irrigation

**Unit 4 Cultivation practices of fruit crops 22 Hrs.**

- 4.1 Area, production, climate, soil, cultivar, propagation, nursery, training, pruning, cultural operation, insect pest, disease, disorder, fruiting, harvesting, marketing, disease, insect pest, techniques of crop cutting etc.
  - 4.1.1 Tropical fruits: Mango, Banana, Pineapple, Papaya, Jackfruit, Litchi, Coconut, Avocado,
  - 4.1.2 Subtropical fruits: Mandarin orange, Sweet orange, Lime, Lemon, guava, pomegranate, Grapes
  - 4.1.3 Mild- temperate fruits: Pear, Peach, Kiwi fruit, Persimmon, Plum, Strawberry
  - 4.1.4 Temperate fruits: Apple, Walnut, Almond
- 4.2 Cultivation practices of minor, indigenous and potential fruits (Brief)

**Practical**

- Unit 1: Identify fruit & plantation crops grown in different agro climatic zone in Nepal 1 Hr.
- Unit 2: Prepare map of fruit crops in different production niches 1 Hr.
- Unit 3: Design a layout of fruit orchard 2 Hrs.
- Unit 4: Calculate plant population in different layout systems 2 Hrs.
- Unit 5: Dig, fill pits and plant the available fruit saplings 2 Hrs.
- Unit 6: Practice air layering 2 Hrs.
- Unit 7: Practice cutting in major fruit crop 2 Hrs.
- Unit 8: Practice training in available fruit tree 2 Hrs.
- Unit 9: Practice fertilizer application in fruit tree 2 Hrs.
- Unit 10: Prepare and apply of Bordeaux mixture 2 Hrs.
- Unit 12: Practice artificial ripening in fruit 2 Hrs.
- Unit 13: Practice pruning in fruit tree 2 Hrs.
- Unit 14: Practice budding for fruit sapling production 2 Hrs.
- Unit 15: Practice inarching in mango 2 Hrs.
- Unit 16: Observe hi tech fruit nursery 2 Hrs.
- Unit 17: Estimate yield (crop cutting) in major fruit crops 2 Hrs.

**References:**

1. Bal, J.S. 1990. Fruit Growing. Kalyani Publishers, India. Bose, T.K., S.K. Mitra and D. Sanyal. 2001. Fruits: Tropical & subtropical. NayaPrakash, India.
2. Chattopadhyaya, T.K. 1996. A Text Book on Pomology (Vol. I-III). Kalyani Publishers, India.

3. Kumar, N., K. Abdul, P. Rangaswami, and I. Irulappan. 2000. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Oxford & IBH Publishing Co. Pvt. Ltd. Shrestha, G. K. 1998.
4. Fruit Development in Nepal: Past, present and future. Technica Concern, Kathmandu, Nepal.
5. Shrestha, G. K. 2010. Applied Fruit Science. Sajha Prakashan, Pulchok, Lalitpur, Nepal.
6. Shrestha, G.K. 2016. Fruit and Plantation Crop Production: Basic Principles, Production Techniques and Practical Exercises. Heritage Publ. and Dist., Bhotahity, Kathmandu, Nepal.
7. Westwood, M. N. 1993. Temperate-zone Pomology: Physiology and culture. Portland, Or: Timber Press.

### **Final written exam marking scheme**

Unit	1	2	3	4	Total
Unit Hours	5	15	18	22	60
Marks	5	20	25	30	80

## Post-Harvest Technology

(AG3104PS)

**Year: III**  
**Semester: I**

**Total: 5 hours /week**  
**Lecture: 3 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide knowledge about the physiology of harvested fruits, vegetables and ornamentals. The course includes the understandings of major physiological activities and biological changes that reduce the postharvest life of fresh products. Various factors that affect shelf life of the produce are incorporated in the course. Also, the course covers basic methods of primary processing such as grading, sorting, cleaning, de-handing, trimming, packaging and storage will be practiced. Principle and practices of processing and preservation is included.

### Course objectives:

After completion of this course students will be able to:

1. Describe importance and scope of postharvest management;
2. Discover changes in horticultural produce i.e., fruits vegetables and cut flowers after harvest;
3. Apply methods to minimize postharvest loss of horticulture produce during harvesting, handling and marketing;
4. Determine appropriate stage of maturity to harvest crop and handle (sorting, trimming, grading, packaging, transportation etc.) carefully to extend their shelf life;
5. Prepare various products such as jam, jelly, marmalade, juice, ketchup, juice, pickles and dried products.

### Theory

**Unit 1: Scope and Importance of postharvest management: 5 Hrs.**

- 1.1. History of postharvest technology
- 1.2. Primary and secondary processing
- 1.3. Scope and Importance of postharvest technology

**Unit 2: physical and chemical changes of horticulture product: 5 Hrs.**

- 2.1. Basic difference in attach and detach organ
- 2.2. Define and Explain Respiration
- 2.3. Respiration and its effect in shelf-life of harvested product
- 2.4. Define transpiration and explain how transpiration affects postharvest self-life
- 2.5. Ethylene production and its effect on Post-harvest self-life
- 2.6. Other physical and chemical changes during ripening

**Unit 3: Maturity and harvesting: 10 Hrs.**

- 3.1. Harvesting, handling, packing house operations and various postharvest practices
- 3.2. Appropriate time of harvesting or Maturity indices of different fruits and vegetables
- 3.3. Fungicide treatment, smoking, sulphuring, Packaging and transportation
- 3.4. Harvesting techniques of major crops.
- 3.5. Method and crop cutting

- Unit 4: Storage:** **5 Hrs.**
- 4.1. Factors affecting storage: temperature, relative humidity, gases and pre-cooling of the produce
  - 4.2. Principles and methods of storage for horticulture commodity and cereals
  - 4.3. Methods of storage; cold storage, modified atmosphere storage, controlled atmosphere storage, cellar storage, rustic storage etc.

- Unit 5: Processing and preservation of fruits and vegetables:** **10 Hrs.**
- 5.1. Principal and practices of preservation
  - 5.2. Practices of canning and bottling
  - 5.3. Heat treatment and Pasteurization
  - 5.4. Preservation by addition of sugar, salt and other preservatives

- Unit 6: Post harvest loss management.** **10 Hrs.**
- 6.1. Identification of major insect, pest, disease and disorder that affects harvested
  - 6.2. Product of vegetable, fruits, field crops and flowers
  - 6.3. Insect and pest management of major Agri product during and after harvesting.
  - 6.4. Post-harvest management of major disease and disorders
  - 6.5. Method of post-harvest loss measurement

**Practical**

- |          |   |        |
|----------|---|--------|
| Unit 1:  | Identify of laboratory equipment, tools and chemicals                                 | 2 Hrs. |
| Unit 2:  | Monitor temperature and relative humidity   | 2 Hrs. |
| Unit 3:  | Perform maturity Judgment   | 4 Hrs. |
| Unit 4:  | Perform harvesting and grading  | 2 Hrs. |
| Unit 5:  | Perform harvesting and market cut flowers   | 2 Hrs. |
| Unit 6:  | Perform Packaging of fruits, vegetables and cut flowers for local and distance market | 2 Hrs. |
| Unit 7:  | Prepare potato chips  | 2 Hrs. |
| Unit 8:  | Prepare candy and murabba   | 3 Hrs. |
| Unit 9:  | Prepare juice and squashes  | 3 Hrs. |
| Unit 10: | Prepare pickle and sauces   | 3 Hrs. |
| Unit 11: | Prepare Jam, Jelly or marmalade   | 3 Hrs. |
| Unit 12: | Perform organoleptic taste and hedonic rating to judge Quality                        | 2 Hrs. |

**References:**

1. Gautam D.M., & Bhattarai, D.R. (2012). *Postharvest horticulture*. New Plaza, Kathmandu, Nepal.
2. Bautista, O.K. (1990). *Postharvest technology of southeast Asian perishable crops*. Technology and Livelihood Resource Center, Philippines.
3. Kader, A.A. (2002). *Postharvest technology of horticultural crops*. University of California Agriculture and Natural Resources Publications, California, USA.
4. Pandey, P.H. (1997). *Postharvest technology of fruits and vegetables*. Saroj Prakashan, Allahabad, India.
5. Gustavo, V. B. (2003). Handling and preservation of fruits and vegetables by combined method for rural areas. *Technical manual* (149). Food and Agriculture Organization, Rome.

**Final written exam marking scheme**

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

## **Agriculture Extension and Communication**

(AG3105PS)

**Year: III**  
**Semester: I**

**Total: 6 hours /week**  
**Lecture: 4 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### **Course description:**

This course is designed to provide the knowledge and skills on different types and forms of education, their philosophy, principles, objectives, process and practices. This course will help to develop students' understandings and ability to apply the knowledge of agricultural extension system. This course also studies teaching and learning process, communication process, rural leadership development and farmers' training in agriculture extension.

### **Course objectives:**

After completion of this course, the students will be able to:

1. Explain importance of education and extension education and extension service;
2. Explain principle, philosophy, teaching and learning in agricultural extension;
3. Apply the knowledge of extension education in TOT, program planning, monitoring and evaluation of agricultural extension programs;
4. Communicate effectively with individuals and group in variety of setting by using different means of communication.
5. Apply the leadership styles in different set of community situation while designing, implementing and evaluating the extension program;
6. Apply the knowledge of teaching learning theory, laws of learning and teaching methods in different context and situation of adult learning.

### **Course Contents:**

#### **Theory**

#### **Unit: 1 Introduction to Education: 3 Hrs.**

- 1.1. Meaning, concept and definition of education, and behavior change
- 1.2. Types of education: Formal, non-formal and informal
- 1.3. Role and importance of education in rural development

#### **Unit: 2 Extension Education System in Nepal 10 Hrs.**

- 2.1 Meaning, concept, origin and history of extension education
- 2.2 Objective, area and scope of extension education
- 2.3 Principles of extension education
- 2.4 Need and importance of extension education.
- 2.5 Historical development of agricultural extension in Nepal
- 2.6 Current Organizational structure of Agriculture and Livestock Development (central, provincial & local govt)
- 2.7 agricultural Extension system and approaches used in Nepal
- 2.8 Present extension system used in Nepal

#### **Unit: 3 Teaching and learning process 10 Hrs.**

- 3.1 Meaning and concept of teaching and learning
- 3.2 Elements and steps of teaching learning process

- 3.3 Theory of learning, Principles of learning and law of learning
- 3.4 Factor affecting adult learning
- 3.5 Extension teaching method: meaning concept and classification of teaching methods
- 3.6 Extension teaching methods: Individual, Group, Mass method/contact
- 3.6 Audio-visual aids – Meaning, concept, nature and classification
- 3.7 Factors of consideration while selecting the teaching methods

**Unit: 4 Communication process** **12 Hrs.**

- 4.1 Meaning and definition of communication, elements of communication
- 4.2 Basis of classification and types of communication
- 4.3 Development communication, meaning and concept of communication in development
- 4.4 Function of communication in extension work
- 4.5 Principles of communication
- 4.6 Models of communication process
- 4.7 Types of communication channels
- 4.8 Barriers of communication
- 4.9 Feedback system of communication in communication process
- 4.10 ICT in agriculture: use, types function in Nepalese context and situation

**Unit 5: Transfer of technology** **5 Hrs.**

- 5.1 Meaning of technology and transfer of technology, horizontal and vertical technology transfer
- 5.2 Meaning and concept of adoption, diffusion and innovation, difference between adoption and diffusion, attributes of technology
- 5.3 Adoption process,
- 5.4 Adopters category and their characteristics
- 5.5 Factor affecting adoption of innovation in decision making process

**Unit 6: Program planning, monitoring and evaluation in extension** **6 Hrs.**

- 6.1 Meaning, concept and importance of program, planning and program planning.
- 6.2 Principle of program planning, types of program planning
- 6.3 Basic Steps in program planning of extension program
- 6.4 Program planning process in federal, provincial and local level govt
- 6.5 Meaning and concept of monitoring and evaluation of extension program
- 6.6 Designing an evaluation plan Basic steps in evaluating extension program

**Unit: 7 leadership development** **6 Hrs.**

- 7.1 Meaning, concept, type of leader and leadership
- 7.2 Basic elements and importance of leadership in extension
- 7.3 Qualities/characteristics, role leader in community development
- 7.4 Selection and development of local leader

**Unit: 8 Farmers' training** **5 Hrs.**

- 8.1 Concept and definition of training, need of farmers training
- 8.2 Capacity and need assessment of farmers training
- 8.3 Designing and planning of farmers training Process of training
- 8.4 evaluating the training program
- 8.5 Development and management of training program

**Unit: 9 Motivation** **3 Hrs.**

- 9.1 Meaning, concept and definition of motivation
- 9.2 Purpose and process of motivation
- 9.3 Factor affecting motivation
- 9.4 Techniques of motivation

**Practical**

Practical	Topic	Time
Unit 1:	Visit farming community and farmer's group and observe the scale of production types of farming, farming plan, components of farming	6 Hrs.
Unit 2:	Prepare individual level farm production plan i) crop production ii) livestock production	2 Hrs.
Unit 3:	Visit, observe and interact with agriculture extension offices/veterinary hospital and livestock service expert center and study their organizational mechanism	8 Hrs.
Unit 4:	Conduct farmers training need	2 Hrs.
Unit 5:	Prepare pamphlet, leaflets and folders	2 Hrs.
Unit 6:	Prepare radio/TV script, folk song, and one act drama	2 Hrs.
Unit 7:	Participate and observe in fair, exhibition, field day and field tour	2 Hrs.
Unit 8:	Conduct method demonstration	2 Hrs.
Unit 9:	Conduct result demonstration	2 Hrs.
Unit 10:	Prepare a training program	2 Hrs.

**Reference books:**

1. Ban, A.W., Den, V., & Hawkins, H.S. (1998). *Agricultural extension*. K. Jain for CBS Publishers and Distributors, New Delhi, India.
2. Bhusan, V., & Sachdeva, D.R. (1994). *An introduction to sociology*. Kitab Mahal, Allahabad.
3. Chitambar, J. V. (1973). *Introductory rural sociology*. Wiley Eastern Ltd., India.
4. Dongol, B. B. S. (2004). *Extension education*. Pratima Singh Dongol, Kathmandu, Nepal.
5. Mathialagan, P. (2007). *A textbook of animal husbandry & livestock extension*. International Book Distributing Co., Lucknow, India.
6. Nakkiran, S., & Ramesh, G. (2010). *Research method in rural development*. Deep and Deep Publication Pvt. Ltd., New Delhi, India.
7. Sandhu, A. A. (1993). *A textbook of communication process and method*. Raju Primlani for Oxford & IBH Publishing Company Pvt. Ltd., New Delhi, India.
8. Shankar Roa, C. N. (2011). *Sociology: Principle of sociology with an introduction to social thought*. S. Chand & Company Ltd., New Delhi, India.

**Final written exam marking scheme**

Unit	1	2	3	4	5	6	7	8	9	Total
Unit Hours	3	10	10	12	5	6	6	5	3	60
Marks	5	10 or 15	10 or 15	15	5	5 or 10	5 or 10	5	5	80

## **Agribusiness, Marketing and Cooperative**

(AG3106PS)

**Year: III**  
**Semester: I**

**Total: 3 hours /week**  
**Lecture: 2 hours/week**  
**Tutorial: hour/week**  
**Practical: 2/2 hours/week**  
**Lab: hours/week**

### **Course description:**

This course is designed to provide the knowledge on agribusiness management, agribusiness environment, organization, management function and human resource development, investment appraisal criteria, business risk and uncertainty. The course also introduces cooperatives and their significance in agriculture. On the marketing part of course, it covers introduction to agricultural marketing, marketing function, and marketing channel and marketing efficiency, supply chain, value chain and government intervention.

### **Course objectives:**

After completion of this course students will be able to:

1. Describe general concept of agribusiness and cooperatives with relation to production, distribution, marketing and consumption;
2. Appraise the investment in agriculture project;
3. Locate business risk and their management strategies;
4. Identify market linkage and market functions of different market actors;
5. Explain the effect of government intervention;
6. Calculate market efficiency.

### **Course Contents:**

#### **Theory**

- |  |               |
|--|---------------|
| <b>Unit 1: Introduction to Agribusiness Management:</b>                            | <b>2 Hrs.</b> |
| 1.1. Concept and definition of agribusiness and agribusiness management            |               |
| 1.2. Scope of agribusiness   |               |
| 1.3. Importance of agribusiness  |               |
| 1.4. Problem and prospects of agribusiness development in Nepal                    |               |
| <b>Unit 2: Basic Concept of Firm, Plant and Industry:</b>                          | <b>2 Hrs.</b> |
| 2.1 Concept of firm, plant and industry  |               |
| 2.2 Interrelationship between firm, plant and industry                             |               |
| <b>Unit 3: Agribusiness Environment:</b>   | <b>1 Hr.</b>  |
| 3.1 Business enabling environment  |               |
| <b>Unit 4: Organization, Management Function &amp; Human Resource Development:</b> | <b>2 Hrs.</b> |
| 4.1 Organization and function of organization                                      |               |
| 4.2 Business management function   |               |
| 4.3 Managerial decision process in agribusiness                                    |               |
| 4.4 Human resource development and its function                                    |               |
| <b>Unit 5: Investment Appraisal Criteria</b>                                       | <b>3 Hrs.</b> |
| 5.1 General concept of different discounting criteria of investment appraisal      |               |
| 5.2 General concept of different non-discounting criteria of investment appraisal  |               |

<b>Unit 6: Risk and Uncertainty:</b>	<b>2 Hrs.</b>
6.1 Concept of risk and uncertainty and their types	
6.2 Management of business risk	
<b>Unit 7: Cooperative:</b>	<b>3 Hrs.</b>
7.1 Definition, principle and objectives of cooperative	
7.2 Cooperative farming and its importance	
7.3 Cooperative marketing and its importance	
7.4 Role of cooperative in agriculture commercialization	
<b>Unit 8: Introduction to Agricultural Marketing:</b>	<b>3 Hrs.</b>
8.1 Concept of agricultural market and marketing.	
8.2 Importance and problem of agri-marketing	
8.3 Marketing vs selling approach	
8.4 Difference between marketable surplus and marketed surplus	
8.5 Market intermediaries	
<b>Unit 9: Marketing Functions</b>	<b>3 Hrs.</b>
9.1 Primary function: assembling, processing and dispersion	
9.2 Secondary Function: standardization and grading, packaging, transportation, storage, financing, risk bearing and selling	
9.3 Marketing function given by Kohls and Uhl.	
<b>Unit 10: Marketing Channel and Marketing Efficiency</b>	<b>3 Hrs.</b>
10.1 General marketing channels of major crops and livestock products	
10.2 Price spread and producers share	
10.3 Marketing Efficiency: technical, operational and price efficiency	
<b>Unit 11: Supply chain and value chain</b>	<b>3 Hrs.</b>
11.1 Concept of Value Chain, Supply Chain, Backward and Forward Linkage	
11.2 Supply chain management: concept, definition and importance	
11.3 Value addition in the product and factors affecting in value addition of the product	
11.4 Value chain map	
<b>Unit 12: Basic concept on government intervention in production and marketing</b>	<b>3 Hrs.</b>
12.1 Floor price and its effect	
12.2 Ceiling price and its effect	
12.3 Taxation and its effect	
12.4 Subsidies and its effect	

### **Practical**

Unit 1: Describe management structure, activities, business environment, investment, profit and risk of agribusiness firm/company / cooperative.	2 Hrs.
Unit 2: Identify major institutions and their roles related to agricultural product markets in Nepal.	2 Hrs.
Unit 3: Appraise financial status of agriculture project by discounted criteria (NPV, B/C ratio, IRR) and non-discounted criteria (PBP, SRR, ROI).	3 Hrs.
Unit 4: Identify major business risk and safeguard majors.	1 Hr.
Unit 5: Discover value chain map, backward linkage and forward linkage of HVC's.	2 Hrs.

Unit 6: Estimate production and marketing cost of any HVC at various chain level and calculate price spread, producer's share and market efficiency. 3 Hrs.

Unit 7: Identify various marketing functions operated by the market intermediaries (collector, trader, processor) 2 Hrs.

**References:**

1. Acharya, S.S. & Agarwal, N.L. (2011). *Agricultural marketing in India* (5<sup>th</sup> ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Pandey, M., & Tewari, D. (2010). *The Agribusiness book: Marketing and value chain perspective*. IBDC Publisher, New Delhi.
3. Broadway, A.C., & Broadway-Arif, A.A. (2008). *Textbook of agribusiness management*. Kalyani Publisher, New Delhi, India.
4. Zimmerer, 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	6	5	7	8	9	10	11	12	Total
Unit Hours	2	2	1	2	2	3	3	3	3	3	3	3	30
Marks	5		5		5 or 10		5 or 10		10 or 15			40	

## Ornamental Horticulture

(AG3107PS)

**Year: III**  
**Semester: I**

**Total: 5 hours /week**  
**Lecture: 3 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the knowledge on importance, present status of ornamental horticulture, gardening and bio-aesthetic planning of Nepal. It includes the skills, principles and practices of flower production, landscaping, indoor and outdoor gardening. It covers the propagation, nursery management and post-harvest management of the ornamental plants.

### Course objectives:

After completion of this course students will be able to:

1. Describe the status scope and importance of ornamental plants in Nepal;
2. Identify the suitable ornamental plants for grown in different agro-climatic regions;
3. Establish nursery for ornamental plants;
4. Propagate ornamental plants;
5. Plan the different styles of gardening;
6. Perform landscaping, gardening and bio-aesthetic planning.

### Course Contents:

#### Theory

#### **Unit 1: Introduction to the ornamental horticulture 3 Hrs.**

- 1.1. Common terms used in ornamental horticulture
- 1.2. Meaning, importance and scope of floriculture in Nepal
- 1.3. Status of floriculture in Nepal
- 1.4. Classification of ornamental plants

#### **Unit 2: Development, construction and maintenance of different garden 8 Hrs.**

- 2.1. Definition, importance and classification
- 2.2. Meaning and scope
- 2.3. Elements and component of garden
- 2.4. Styles of garden
- 2.5. Principles of landscape gardening
- 2.6. Landscape designs
- 2.7. Preparation and maintenance of lawn

#### **Unit 3: Cultivation practices of commercial cut flower and ornamental plants 10 Hrs.**

- 3.1. Cultivation practice with respect, area of production and trade, variety, soil and climatic requirement, propagating materials, planting, manuring, training and pruning, and disease and insect management, flowering/harvesting season, method of harvesting, (rose, tuberose, gladiolus, marigold, dahlia, chrysanthemum, gerbera, carnation, orchids, ferns and cactus)
- 3.2. Post-harvest aspect of cut flower and vase solution

#### **Unit 4: Indoor gardening 8 Hrs.**

- 4.1. Definition and importance of indoor gardening
- 4.2. Selection and maintenance of plants
- 4.3. Pot culture, hanging baskets and other method of decoration.
- 4.4. Flower arrangement and Ekebana

- 4.5. Potting and repotting
- 4.6. Bonsai making

**Unit 5: Introduction to nursery and nursery media** **8 Hrs.**

- 5.1. Definition of nursery
- 5.2. Status of flower nurseries in Nepal
- 5.3. Definition of growth Media, growth media used and their characters
- 5.4. Pots and container available in Nepal
- 5.5. Tools and equipment used in flower nursery and their functions.
- 5.6. Nursery Structure: green house, shade house, lath house and their use
- 5.7. Propagating structure of flowers and ornamental plants,

**Unit 6: Care and maintenance of ornamental plants** **5 Hrs.**

- 6.1. Types of container
- 6.2. Problem of container grown plants,
- 6.3. Root pruning and shoot pruning,
- 6.4. Hardening of seedling, Insect pest management
- 6.5. Packing material and marketing

**Unit 7: Packaging and Marketing of Cut Flowers** **3 Hrs.**

- 7.1. Definition, objectives, methods and criteria of good packaging
- 7.2. Packing material and marketing

**Practical**

- Unit 1: Identify of ornamental plants and preparation of herbarium 2 Hrs.
- Unit 2: Prepare landscape designs for residential and public places 3 Hrs.
- Unit 3: Practice on preparation and maintenance of a lawn 2 Hrs.
- Unit 4: Prepare a flower bouquet 2 Hrs.
- Unit 5: Prepare media and soil mixture for container grown plants 2 Hrs.
- Unit 6: Prepare a bonsai 2 Hrs.
- Unit 7: Prepare a nursery media 2 Hrs.
- Unit 8: Sketch a garden layout 3 Hrs.
- Unit 9: Prepare nursery bed to transplant cutting 2 Hrs.
- Unit 10: Perform propagation by grafting and budding 2 Hrs.
- Unit 11: Perform propagation by cutting 2 Hrs.
- Unit 12: Perform root pruning and shoot pruning of potted plant 2 Hrs.
- Unit 13: Perform handling and packaging practices of flowers 2 Hrs.
- Unit 14: Visit and describe a nursery and flower exhibition 2 Hrs.

**References:**

1. Arora, J.S. (2016). *Introductory ornamental horticulture* (8<sup>th</sup> ed.). Kalyani Publishers, India.
2. Bose, T.K. & Yadav, L.P. (1989). *Commercial floriculture*. Floritech Publisher, Bangalore, India.
3. Randhawa, G.S. (1973). *Ornamental horticulture in India*. Today and Tomorrows Printers and Publ., India.
4. Randhawa, G.S. & Mukhopadhya, A. (1986). *Floriculture in India*. Allied Publ. Ltd., India.
5. Somani, L.L. (1996). *Dictionary of gardening*. Agro-tech. Publishing Academy, Udaipur.

**Final written exam marking scheme**

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

## Seed Technology

(AG3108PS)

**Year: III**  
**Semester: I**

**Total: 5 hours /week**  
**Lecture: 3 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide the basic concepts of seed technology, seed and quality seeds; seed growth, dormancy, germination, vigour and longevity; principles of seed production; types of varieties and seed production schemes; influence of seed quality on crop establishment, growth and yield; foundation and certified seed production; seed drying, cleaning, upgrading, testing, certification, legislation and intellectual property rights.

### Course objectives:

After completion of this course students will be able to:

1. Describe the basic concepts of seed technology;
2. Explain about physiology, quality seeds and improved seeds;
3. Apply basic seed production principles and skills of different crops;
4. Describe seed processing, seed testing, seed certification, legislation and intellectual property rights;
5. Apply technical knowledge and skills in seed production and seed testing.

### Course Contents:

#### Theory

- |   |               |
|---|---------------|
| <b>Unit 1: Basic concepts of seed technology, seed and quality seeds:</b>                     | <b>5 Hrs.</b> |
| 1.1. Definition of seed technology, seed, grain and quality seed                              |               |
| 1.2. Roles, goals and relationship to other sciences of seed technology                       |               |
| 1.3. Importance and scope of seed and its nutritional value.                                  |               |
| 1.4. Seed quality characteristics and types of improved seeds                                 |               |
| <b>Unit 2: Seed growth, dormancy, germination, vigour and longevity:</b>                      | <b>6 Hrs.</b> |
| 2.1. Seed formation, development and growth and factors affecting seed growth and development |               |
| 2.2. Seed dormancy and factors affecting it and breaking seed dormancy                        |               |
| 2.3. Seed germination and factors affecting it  |               |
| 2.4. Seed vigour and its role in crop establishment   |               |
| 2.5. Seed longevity and causes of seed deterioration  |               |
| <b>Unit 3: Principles of seed production:</b>   | <b>8 Hrs.</b> |
| 3.1. Genetic and agronomic principles of seed production                                      |               |
| 3.2. Principles and schemes of nucleus and breeder's seed production                          |               |
| 3.3. Hybrid seed production   |               |
| <b>Unit 4: Types of varieties and seed production schemes:</b>                                | <b>5 Hrs.</b> |
| 4.1. Definition and types of different varieties  |               |
| 4.2. Production schemes of different varieties  |               |
| 4.3. Definition and types of different hybrids  |               |
| 4.4. Production scheme of hybrids using male sterile and self-incompatible lines              |               |
| <b>Unit 5: Influence of seed quality on crop establishment, growth and yield:</b>             | <b>6 Hrs.</b> |
| 5.1. Factors affecting plant density and crop yield   |               |
| 5.2. Seeding and stand establishment  |               |

- 5.3. Seed quality and seedling emergence
- 5.4. Effects of seedling emergence on crop yield
- 5.5. Seed quality and post emergence growth and crop yield

**Unit 6: Influence of seed quality on crop establishment, growth and yield: 6 Hrs.**

- 6.1. Principles of nucleus, breeder, foundation and certified seeds
- 6.2. Techniques of seed production in cereals, pulses, oilseed crops, vegetable crops and other crop seeds

**Unit 7: Seed drying, cleaning, upgrading, testing, certification, legislation and intellectual property rights: 9 Hrs.**

- 7.1 Methods and procedures of seed drying, cleaning, upgrading and seed testing  
Seeding and stand establishment
- 7.2 Minimum seed certification standards of different crops
- 7.3 Field and seed inspection.
- 7.4 Seed legislation and seed law
- 7.5 Intellectual property rights, forms of intellectual property rights protection

**Practical**

**Unit 1: Identify of seeds of various field crops in the laboratory 4 Hrs.**

- Seed and grain
- Nutritional value of seed
- Identification of different types of various crops
- Observable characteristics of seed of various crops
- Seed collection

**Unit 2: Test the seed Purity in laboratory 2 Hrs.**

- Seed lot/sample and seed purity
- History of seed testing
- Components of seed lot
- Importance of doing purity test
- Procedures of purity test
- Observation, recording and calculation of purity test and drawing conclusions

**Unit 3: Test seed viability and moisture in laboratory 2 Hrs.**

- Importance of seed viability and moisture testing
- Methods and procedures of seed viability and moisture testing
- Observation, recording and calculation of seed viability and seed moisture and drawing conclusions

**Unit 4: Test seed germination in laboratory and field 4 Hrs.**

- Seed germination and its types
- Methods of seed germination test in lab and field
- Observation, recording and calculation of germination test
- Comparison, of germination test in lab and field and drawing conclusions
- Real value of seed

**Unit 5: Perform seed production techniques of self-pollinated crops 2 Hrs.**

- Mode of pollination of self-pollinated crops
- Listing self-pollinated crops
- Pollination behavior, time and floral morphology of self-pollinated crops
- Seed production principles of self-pollinated crops
- Seed production steps of self-pollinated crop available in growing season

**Unit 6: Perform Seed production techniques of cross-pollinated crops 2 Hrs.**

- Mode of pollination of cross-pollinated crops
- Listing cross-pollinated crops
- Pollination behavior, time and floral morphology of cross-pollinated crops
- Seed production principles of cross-pollinated crops
- Seed production steps of cross-pollinated crop available in growing season

**Unit 7: Perform hybrid seed production technique** **2 Hrs.**

- Survey and methods of surveying
- Seed storage structures
- Seed production system adopted by farmers
- Submission of a survey report

**Unit 8: Study visit to seed processing plant and seed testing laboratory** **4 Hrs.**

- Seed drying, cleaning and grading
- Seed processing procedures
- Seed testing methods and steps
- Observation of seed processing plant and seed testing lab
- Submission of report

**Unit 9: Study visit to public/private seed multiplication farms** **4 Hrs.**

- Type of seed multiplication farms
- Type of seed multiplication
- Seed multiplication procedure from seed selection of harvesting
- Observation of seed multiplication farms
- Submission of report

**Unit 10: Study seed storage structures and seed production system adopted by farmers** **4 Hrs.**

- Survey and methods of surveying
- Seed storage structures
- Seed production system adopted by farmers
- Submission of survey report

**References:**

1. Agrawal, R. L. (2005). *Seed technology*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.
2. Barsa, A. S. (Ed). (2002). *Seed quality: Basic mechanisms and agricultural implications*. The Haworth Press. Inc., USA.
3. McDonald, M. B., & Copeland, L. O. (1998). *Seed production: Principles and practices*. Chapman and Hall. Inc., New York.

**Final written exam marking scheme**

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

**Third Year/ Second Semester**

## Elementary Agricultural Statistics

(AG3201PS)

**Year: III**  
**Semester: II**

**Total: 3 hours /week**  
**Lecture: 2 hours/week**  
**Tutorial: 1 hour/week**  
**Practical: hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide basic knowledge on Statistics, oriented to agricultural and livestock production. The first part of the course covers descriptive statistics and the second part covers inferential statistics. The course provides the skills on the application of basic statistical methods to agricultural sciences. The entire course deals with assessing, acquiring, and developing statistical knowledge, attitude, skills and tools that are necessary to agricultural research at elementary state.

### Course objectives:

After completion of this course students will be able to:

1. Understand the concept of fundamentals of statistics;
2. Explore elementary statistical methods to collect, organize, present and interpret agricultural data in a scientific way;
3. Distinguish between descriptive statistics and inferential statistics;
4. Apply statistical methods through computer application to describe, and analyze agricultural data to draw inferences about the population and
5. Manage agricultural data for their future use.

### Course Contents:

#### Theory

#### **Unit 1: Introduction to Statistics & the fundamentals** **2 Hrs.**

- 1.1. Introduction, origin, meaning, definition and uses of statistics, role of statistics in agricultural research, limitations and abuses of statistics.
- 1.2. Variables, measurement of scale, statistical notations, population, sample, parameter, statistics, sampling distribution and standard error.

#### **Unit 2: Organization of Data** **2 Hrs.**

- 2.1. Organization of data, ordered array, frequency distribution, purpose of frequency distribution, frequency distribution of grouped data
- 2.2. Exclusive and inclusive type of classification, converting inclusive type of classification into exclusive type, mid values and the class boundaries, principles of classification, guidelines to classify data

#### **Unit 3: Presentation of Data** **2 Hrs.**

- 3.1. Statistical diagrams, simple bar diagram, sub-divided bar diagram, percentage bar diagram, multiple bar diagram
- 3.2. Pie-chart, frequency curves and ogives

#### **Unit 4: Measurement of Central Tendency** **2 Hrs.**

- 4.1. Introduction, characteristics of good measures of central tendency, mean, median, and mode

- 4.2. Characteristics and uses of mean, median and mode in real life

**Unit 5: Measures of Dispersion** **2 Hrs.**

- 5.1. Meaning, purpose and definition of dispersion statistics, absolute and relative measures of dispersion
- 5.2. Commonly used measures of dispersion: range, quartile deviation, mean deviation, mean squared deviation, variance, standard deviation and coefficient of variation.

**Unit 6: Measures of Shape** **2 Hrs.**

- 6.1. Skewness, positively and negatively skewed curves, Karl Pearson's coefficient of skewness
- 6.2. Kurtosis, leptokurtik, mesokurtik and platy kurtik curves

**Unit 7: Probability Theory** **4 Hrs.**

- 7.1. Methods of counting: factorial rule, permutation, combination, experiment, random experiment, outcomes and sample space, total possible cases and favorable cases in a random experiment, definition of probability
- 7.2. Events: equally likely events, mutually exclusive events, exhaustive events, independent events, sure event, impossible event.
- 7.3. Additional rule of probability, multiplication rule of probability, conditional probability
- 7.4. Definition of probability distribution [no details are to cover. only a conceptual introduction to probability distribution], characteristics of a probability distribution

**Unit 8: Correlation and Regression Analysis** **2 Hrs.**

- 8.1. Concept of correlation, types of correlation
- 8.2. Estimation of correlation through scatter diagram, Karl Pearson's coefficient of correlation, coefficient of determination, interpretation of correlation coefficient, and properties of correlation coefficient
- 8.3. Concept of regression, simple linear regression, properties of regression coefficients, relation between correlation coefficient and regression coefficient.

**Unit 9: Introduction to Sampling Theory** **2 Hrs.**

- 9.1. Meaning and importance of sampling
- 9.2. Probability sampling: simple random sampling, stratified sampling, systematic sampling, cluster sampling and multistage sampling.
- 9.3. Non-probability sampling: convenience sampling, quota sampling, judgments sampling and characteristics of a good sample

**Unit 10: Hypothesis Testing** **7 Hrs.**

- 10.1. Concept of hypothesis testing: null and the alternate hypothesis,
- 10.2. Errors in hypothesis testing, Type-1 Error, Type-2 Error, test statistics, decision rule for a hypothesis testing
- 10.3. Basics of large sample tests: Z-test, One-sample Z-test for mean, Two-sample Z-test for means.
- 10.4. Small sample tests: one-sample t-test for mean, two independent sample t-test for sample means, t-test for dependent sample Mean (Paired-T Test).

- 10.5. Chi-square test of goodness of fit, chi-square test for test of independence of factors

**Unit 11: Analysis of Variance**

**3 Hrs.**

- 11.1. Introduction, logic behind analysis of variance, F-test  
 11.2. Introduction to experimental designs.

**References**

1. Agrawal B.L. 1996. Basic statistics (3rd edition), New Age International Pvt. Ltd. New Delhi. Chandel, S.R.S. 1984. A hand book of agricultural statistics. Achal Prakashan Mandir, Kanpur, India.
2. Dhakal, C.P. (2018). A reference manual of statistics for graduate students in agriculture and all time researchers. IAAS, Post Graduate Campus, Tribhuvan University, Kirtipur, Kathmandu.
3. Dhakal, C.P. 2013. Elementary Statistics in Agriculture and Environmental Sciences. Sajha Prakashan. Lalitpur, Nepal.
4. Gupta S.C. and V.K. Kapoor. 1998. Fundamentals of applied statistics, Chand and Com. New Delhi. Singh, S. and R.P.S. Verma. 1982. Agricultural Statistics, Rama Publishers Meerut.
5. Tripathi, P.N. 1991. A manual on introductory agricultural statistics, Tribhuvan University, IAAS, Chitwan, Nepal.

**Final written exam marking scheme**

Unit	1	2	3	4	5	6	7	8	9	10	11	Total
Unit Hours	2	2	2	2	2	2	4	2	2	7	3	30
Marks	5		5		5		5		10		40	

## **Social Mobilization and Community Development** (AG3202PS)

**Year: III**  
**Semester: II**

**Total: 5 hours /week**  
**Lecture: 3 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### **Course description:**

This course will enable the students to select and apply the most appropriate process, approaches and techniques in developing rural and community development programs by appreciating the importance of socially organized groups and their mobilization in the development activities. This course will help to develop students' understandings and ability to learn about contemporary agriculture and process of urbanization. This course will also enable the students to make the wise use of gender concept and issues related to development in most relevant ways.

### **Course objectives:**

After completion of this course, the students will be able to:

1. Explain the different sociological concept and terminology;
2. Explain the term social mobilization, it's history, types, approaches, models and strategy;
3. Identify the scope, role in different Civil society, GOs & NGOs on community development;
4. Explain the concept of group, their typology, importance and group formation procedure;
5. Develop the knowledge and skills in identifying social problems;
6. Explain co-operation, conflict, situation for conflict, conflict management or resolution technique;
7. Describe and compare WID, WAD and GAD.

### **Course Contents:**

#### **Theory**

#### **Unit: 1 Basic sociological concept**

**15 Hrs.**

- 1.1. Meaning, concept and definition of sociology and rural sociology
- 1.2. Natures of sociology: Sociology is a science
- 1.3. Importance of rural sociology in agricultural extension and rural development
- 1.4. Sociological concept and terminology: society and culture,
- 1.5. Society, community, state and nation.,
- 1.6. Social Institution – Family and marriage system,
- 1.7. Social institution: Religion, economic, educational and political institution
- 1.8. Social value, belief, norms, taboos, rituals custom, tradition
- 1.9. Caste and ethnicity, race of Nepal
- 1.10. Social structure: role, status, position, power and prestige
- 1.11. Socialization, social stratification
- 1.12. Meaning and factor of social change
- 1.13. Social problems and means of remedies
- 1.14. Meaning and cause of social movement
- 1.15. Meaning and concept of social process, classification of social process universal and derived social process

- Unit: 2 Social mobilization and community development** **12 Hrs.**
- 2.1 Meaning, concept, purpose and history (in Nepal) of social mobilization
  - 2.2 Lesson learned from the past experience from social mobilization
  - 2.3 Meaning and concept of development,
  - 2.4 Rural and community development: Approaches, strategies and types
  - 2.5 Decentralization: Concept, types, principles, advantages and disadvantages
  - 2.6 Federalism for development: Nepalese experiences
  - 2.7 Local governance: Past experience, Local Governance Operation Act 2017,
  - 2.8 Role of Local agencies, community-based Organization and NGOs in social mobilization
  - 2.9 Concept and principle of sustainability development
  - 2.10 A brief overview of efforts and approaches of rural development in Nepal over the last decades
  - 2.11 Issues and problems of rural development in Nepal

- Unit: 3 Group formation and group dynamics** **12 Hrs.**
- 3.1 Meaning, concept, type and importance of group, why do people join in the group
  - 3.2 Group formation procedure, process and group dynamics
  - 3.3 Natures of social group and group properties
  - 3.4 History of group approach of community development and extension
  - 3.5 Meaning, concept, definition of conflict and its management in social group
  - 3.6 Transition of conflict thought, situation for conflict, conflict intensity continuum
  - 3.7 Measurement of conflict) and conflict management technique
  - 3.8 Social facilitation process: social facilitation, social loafing, group shift, social influence
  - 3.9 Functional group formation: Guideline and rules of operation
  - 3.10 Stages of group formation: Forming, norming, storming and performing

- Unit: 4 Gender and development** **6 Hrs.**
- 4.1 Meaning and concept of gender and sex, gender-based stereotypes
  - 4.2 Origin of Gender and development in global and Nepalese context
  - 4.3 Concept of WID, WAD and GAD, compare and contrast
  - 4.4 Feminization of agriculture, role of women in agriculture and gender issues
  - 4.5 Gender roles, Gender needs, gender strategy
  - 4.6 Gender budget, gender audit and gender sensitive budget, Nepal's rules and Act
  - 4.7 Concept of gender and social exclusion, domains, causes and strategy of mainstreaming
  - 4.8 Nepal's policy, plan act and rules related to the gender mainstreaming

#### **Practical**

- |         |   |        |
|---------|---|--------|
| Unit 1: | Visit of rural community and identify social research issues through problem tree analysis tool | 4 Hrs. |
| Unit 2: | Develop the skills to assess and identify farmer's needs and priority                           | 4 Hrs. |
| Unit 3: | Visit to a village to list out the taboos, folkways, rituals and social values in society       | 4 Hrs. |
| Unit 4: | Study on sampling method and techniques used in social survey                                   | 2 Hrs. |
| Unit 5: | Develop the knowledge and skills of data collection techniques                                  | 2 Hrs. |
| Unit 6: | Develop questionnaire for data collection   | 2 Hrs. |

Unit 7:	Develop the knowledge and skill for information gathering from PRA, RRA: discussion, matrix, analysis, mapping	4 Hrs.
Unit 8:	Develop the skill of descriptive data analysis: table, graph, chart, diagram	4 Hrs.
Unit 9:	Develop the knowledge and skills in report writing and presentation	4 Hrs.

**References:**

1. Jaishi, M., & Paudel, I. (2020). *Social mobilization and community development: Textbook for undergraduate students*. Heritage Publisher Bhoitahity Kathmandu & RDTEC, Lamjung Campus.
2. Dongol, B. B. S. (2004). *Extension education*. Pratima Singh Dongol, Kathmandu, Nepal.
3. Khan, S.S., & Shah, J.S. (2001). *Social mobilization manual based on Syanja experience*, Social Mobilization Experimentation and Learning Center, UNDP/IAAS.
4. Mathialagan, P. (2007). *A textbook of animal husbandry & livestock extension*. International Book Distributing Co., Lucknow, India.
5. Nakkiran, S., & Ramesh, G. (2010). *Research method in rural development*. Deep and Deep Publication Pvt. Ltd., New Delhi, India.
6. Sandhu, A. A. (1993). *A textbook of communication process and method*. Raju Primlani for Oxford & IBH Publishing Company Pvt. Ltd., New Delhi, India.
7. Shankar Roa, C. N. (2011). *Sociology: Principle of sociology with an introduction to social thought*. S. Chand & Company Ltd., New Delhi, India.

**Final written exam marking scheme**

Unit	1	2	3	4	Total
Unit Hours	15	12	12	6	45
Marks	30	20	20	10	80

**Entrepreneurship Development**  
(EG3201MG)

**Year: III**  
**Semester: II**

**Total: 5 hours /week**  
**Lecture: 3 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

**Course description:**

This course is designed to provide the knowledge and skills on formulating business plan and managing small business. The entire course deals with assessing, acquiring, and developing entrepreneurial attitude; skills and tools that are necessary to start and run a small enterprise.

**Course objectives:**

After completion of this course students will be able to:

1. Describe about various forms of enterprise and entrepreneurship;
2. Identify entrepreneurial competencies;
3. Design business ideas and viability;
4. Formulate business plan with its integral components;
5. Manage small farm enterprise.

**Course Contents:**

**Theory**

**Unit 1: Introduction to Business & Entrepreneurship: 9 Hrs.**

- 1.1. Overview of entrepreneur and entrepreneurship
- 1.2. Wage employment, self-employment and business
- 1.3. Synopsis of types and forms of enterprises
- 1.4. Attitudes, characteristics & skills required to be an entrepreneur
- 1.5. Myths about entrepreneurs
- 1.6. Overview of MSMEs (Micro, Small and Medium Enterprises) in Nepal

**Unit 2: Exploring and Developing Entrepreneurial Competencies: 9 Hrs.**

- 2.1. Assessing individual entrepreneurial inclination
- 2.2. Assessment of decision-making attitudes
- 2.3. Risk taking behavior and risk minimization
- 2.4. Creativity and innovation in business
- 2.5. Enterprise management competencies

**Unit 3: Business identification and Selection: 4 Hrs.**

- 3.1. Sources and method of finding business idea(s)
- 3.2. Selection of viable business ideas
- 3.3. Legal provisions for MSMEs in Nepal

**Unit 4: Business plan Formulation: 18 Hrs.**

- 4.1. Needs and importance of business plan
- 4.2. Marketing plan
  - 4.2.1. Description of product or service
  - 4.2.2. Targeted market and customers
  - 4.2.3. Location of business establishment
  - 4.2.4. Estimation of market demand
  - 4.2.5. Competitors analysis
  - 4.2.6. Estimation of market share
  - 4.2.7. Measures for business promotion
- 4.3. Business operation plan

- 4.3.1. Process of product or service creation
- 4.3.2. Required fix assets
- 4.3.3. Level of capacity utilization
- 4.3.4. Depreciation & amortization
- 4.3.5. Estimation office overhead and utilities
- 4.4. Organizational and human resource plan
  - 4.4.1. Legal status of business
  - 4.4.2. Management structure
  - 4.4.3. Required human resource and cost
  - 4.4.4. Roles and responsibility of staff
- 4.5. Financial plan
  - 4.5.1. Working capital estimation
  - 4.5.2. Pre-operating expenses
  - 4.5.3. Source of investment and financial costs
  - 4.5.4. Per unit cost of service or product
  - 4.5.5. Unit price and profit/loss estimation of first year
- 4.6. Business plan appraisal
  - 4.6.1. Return on investment
  - 4.6.2. Breakeven analysis
  - 4.6.3. Risk factors

**Unit 5: Small Business Management: 5 Hrs.**

- 5.1. Concept of small business management
- 5.2. Market and marketing mix
- 5.3. Basic account keeping

**Practical**

**Unit 1: Collect overview of business and entrepreneurship 2 Hrs.**

- Collect business information through interaction with successful entrepreneur

**Unit 2: Explore and Developing Entrepreneurial Competencies 2 Hrs.**

- Generate innovative business ideas

**Unit 3: Identify and select product or service identification and selection 2 Hrs.**

- Analyze business ideas using SWOT method

**Unit 4: Formulate business plan 22 Hrs.**

- Prepare marketing plan
- Prepare operation plan
- Prepare organizational and human resource plan
- Prepare financial plan
- Appraise business plan
- Prepare action plan for business startup

**Unit 5: Manage Small Business 2 Hrs.**

- Prepare receipt and payment account
- Perform costing and pricing of product and service

Units	Title	Hours	Mark distribution
1	Business & Entrepreneurship	10	10
2	Exploring and Developing Entrepreneurial Competencies	10	10
3	Business identification and Selection	5	10
4	Business plan Formulation	40	40
5	Small Business Management	10	10
	<b>Total</b>	<b>75</b>	<b>80</b>

## Internship Program

(AG3204PS)

**Year: III**  
**Semester: II**

**Total: 390 hours**  
**Lecture: hours/week**  
**Tutorial: hour/week**  
**Practical: 390 hours/week**  
**Lab: hours/week**

### Description

In the second semester of the third/final year of their Diploma, students will be placed in different organizations (government organizations – research / extension or private organizations) under supervision to have practical experience of the job market. The duration of the internship is 3 months (390 hours). Internship will start only after the completion of all the subjects in the curriculum. It should end at least two weeks before the final exam conducted by CTEVT. The training institute is responsible for making arrangements for the internship. It should inform the CTEVT with details about the name of the student, internship site, plan and schedule.

### Complete plan

SN	Activities	Duration	Remarks
1	Orientation	2 days	Before placement
2	Report to the site	1 days	Before placement
3	Actual work at the internship site	90 days (390 hours)	During internship period
4	Mid-term evaluation	one week	After 6 to 7 weeks of internship start date
5	Report to the parental organization	1 days	After placement
6	Final report preparation	5 days	After placement
7	Seminar/ evaluation from CTEVT or its nominee (external)	3 days	After 10 days of completion of internship

Mid-term evaluation is done after 6 weeks of placement and can be done by the institute itself or jointly with CTEVT. The students will be given one week after 3 months of internship to review and prepare the final report. The institute will fix the seminar date for the report in consultation with CTEVT. Final evaluation will be done as given below.

S. N	Evaluator	Marks
1	Supervisor of the organization in which the student is placed for the internship	100
2	The Training Institute	100
3	CTEVT or its nominee (external)*	100
	<b>Total</b>	<b>300</b>

## **Objective**

- To make the students familiar with the job/ working areas related to their field of study
- To provide them opportunity to practice the skills they have gained during the academic period.
- To provide them with opportunity to learn about skills those are new or not covered in the institute.
- To explore the opportunities in the job market and plan their career accordingly.

## **Learning key areas**

### **General Learning areas**

- Acquaintance with the process of planning, monitoring and evaluation of annual programme and budgets of the organization.
- Knowing about day to day activities like office management, entry-dispatch of letters, record keeping and staff management.
- Familiarizing with the process of staff appointment, salaries, perks (provident fund and gratuities), other facilities and possibilities of professional development in the organization.
- Data collection, analysis, report writing and presentation

### **Specific learning areas**

1. Farms (Government/ Private)
  - 1.1. Getting involved in nursery and orchard management
  - 1.2. Practicing different forms of propagation in fruits like grafting, layering, cutting etc.
  - 1.3. Performing inter-cultural operations of the fruits and vegetables like training, pruning, weeding, manuring, applying Bordeaux paste etc.
  - 1.4. Learning about new technologies (varieties/ machineries/equipment/ process) demonstrated in the farm
2. Research stations
  - 2.1. Learning the process of conducting a research like layout, tagging, isolation distance etc.
  - 2.2. Learning about taking data, keeping records, analyzing data and evaluating results of the research.
  - 2.3. Knowing about different types of tests/ research conducted in the research station.
  - 2.4. Knowing about different types of varieties and technologies demonstrated in the research station.
  - 2.5. Familiarizing about seed production process in the center
  - 2.6. Getting updated about the germplasms and different breeding lines maintained in the station.
3. Laboratories (Central/ Provincial/ Research)
  - 3.1. Learning about different equipment being used in the laboratories.
  - 3.2. Learning to use the equipment in the laboratories.
  - 3.3. Getting acquaint to handle the samples bought in the laboratories and the procedures conducted before analyzing the samples.
  - 3.4. Learning about different tests to be conducted and interpretation of the tests.

- 3.5. Being able to run the tests and interpret the results independently.
4. Local level
  - 4.1. General information about day to day activities in agriculture and livestock services in grass root level.
  - 4.2. Dealing with farmers demand and queries
  - 4.3. Learning to do crop cutting and yield estimation.
  - 4.4. Conducting basic trainings to the farmers
  - 4.5. Familiarizing with distribution of agricultural inputs like seeds, pesticides etc.
5. Prime Minister Agriculture Modernization Project (PMAMP) blocks, zone and super zones
  - 5.1. Collecting farmers demand
  - 5.2. Assessing farmer's capacities
  - 5.3. Conducting trainings and workshops
  - 5.4. Demonstration of new technologies
  - 5.5. Familiarizing with the modern machineries promoted by the organization.
  - 5.6. Getting acquaint to the consumer management committees of the zones and super zones.
6. Agriculture Knowledge Centers (AKC)
  - 6.1. Learning about agriculture and livestock extension services
  - 6.2. Learning about entrepreneurial experiences
  - 6.3. Learning about selection, implementation and monitoring of activities in relation to agriculture and livestock subsidies.

## **Government Organization in the Agriculture Sector**

### **Federal**

- *Ministry of Agriculture and Livestock Development*
- *Department of Livestock Services*
- *Department of Food Technology and Quality Control*
- *Nepal Agriculture Research Council*
- *Seed Quality Control Centre*
- *Agriculture Information and Training Centre*
- *Plant Quarantine and Pesticide Management Centre*
- *Department of Agriculture*
  - Centre for Agricultural Infrastructure Development and Mechanization Promotion
  - National Centre for Potato, Vegetable and Spice Crops Development
  - National Centre for Fruit Development
  - Centre for Crop Development and Agro Bio-diversity Conservation –
    - Agriculture Farm Chandra Dangi and
    - Kanchanpur
  - Centre for Industrial Entomology Development
  - Central Agricultural Laboratory
- *Prime Minister Agricultural Modernization Project – Super zone, Zone, Block and Pockets*

## **Provincial Level**

- *Ministry of Land Management, Agriculture and Cooperatives*
- *Agriculture Development Directorate*
  - Agriculture Business Promotion Support and Training Centre
  - Agriculture Knowledge Centers
  - District Agriculture Development Offices (In Some provinces e.g.; Karnali)
  - Livestock Service Expert Centre and Veterinary Hospital
  - Agricultural Farm Centers
  - Agricultural Laboratories-
    - Soil Laboratories
    - Seed Laboratories
    - Plant Protection Laboratories

## **Local Level**

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

### Expert involved in Curriculum Revision

S.N.	Expert Name	Designation	Organization
1.	Prof. Bhargab Dhital	Dean	Institute of Agriculture and Animal Science
2.	Khem Raj Dahal	Professor	Institute of Agriculture and Animal Science
3.	Indra Raj Pandey	President	Nepal Horticulture Association
4.	Pradip Poudel	Principal	Tanahun Technical School, Bhimad
5.	Ramesh Humagain	Senior Agriculture Development Officer	Ministry of Agricultural Development, Hariharbhawan
6.	Dr. Huma Neupane	Lecturer	Paklihawa Campus, Paklihawa, Rupandehi
7.	Rekha Sapkota	Lecturer	IAAS, TU
8.	Janma Jaya Gaire	Lecturer	Paklihawa Campus, Paklihawa, Rupandehi
9.	Dr. Rabindra Marahatta	Dept. Head, Animal Science	Jiri Technical School, Jiri
10.	Rambhajan Mandal	Campus Chief	Paklihawa Campus, Paklihawa, Rupandehi
11.	Shanta Pokhrel	Instructor	Shree Ishaneswor Secondary School, Lamjung
12.	Subodh Khanal	Lecturer	IAAS, Biratnagar
13.	Hariram Khanal	Instructor	Jiri Technical School, Jiri
14.	Prakash Ghimire	Lecturer	Paklihawa Campus, Paklihawa, Rupandehi
15.	Prabin Shrestha	Computer Instructor	Nepal Banepa Polytechnic Institute, Banepa
16.	Kumar mani Dahal	Technical Officer	NARC, Khumaltar
17.	Dr Kishor C. Dahal	Assistant Dean	IAAS, TU
18.	Arjun Prakash Poudel	Scientist	NARC, Khumaltar
19.	Bhagawan Das Manandhar	Lecturer	Paklihawa Campus, Paklihawa, Rupandehi
20.	Suma Karki	Senior Crop Development Officer	Ministry of Agricultural Development, Hariharbhawan
21.	Pramila Wagle	Horticulture Development Officer	Ministry of Agricultural Development, Hariharbhawan
22.	Shiromani Gajurel	Lecturer	KAFCOL, Balkumari
23.	Dr. Pusparaj Poudel	Lecturer	Paklihawa Campus, Paklihawa, Rupandehi
24.	Sudeep Devkota	Agriculture Development Officer	Ministry of Agriculture and Livestock Development, Singhadurbar

<b>S.N.</b>	<b>Expert Name</b>	<b>Designation</b>	<b>Organization</b>
25.	Dr. Chuda Dhakal	Reader	IAAS, Kirtipur
26.	Kaladhar Gaire	Senior Curriculum Officer	CTEVT
27.	Suraj Karki	Math Instructor	Nepal Banepa Polytechnic Institute, Banepa
28.	Leena Shah	Asst. Professor	KAFCOL, Balkumari
29.	Yadab Gaire	Lecturer	KAFCOL, Balkumari
30.	Nabin Darai	Lecturer	KAFCOL, Balkumari
31.	Ishwori Dutta Bhatta	Subject Expert	Freelancer
	Shalik Ram Dangi	Senior Agriculture Officer (Senior Trainer)	TITI
32.	Jay Krishna Poudel	Deputy director (Senior Agriculture Officer)	CTEVT
33.	Debesh Devkota	Director (Agriculture expert)	CTEVT