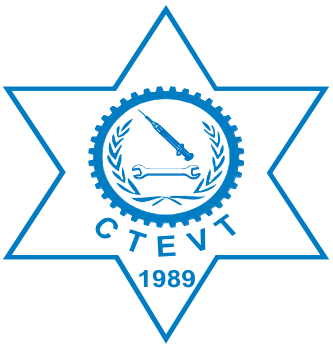
CURRICULUM
for
Diploma in Food and Dairy Technology
(Three-year program-semester system)



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

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Contents

Introduction

Diploma in Food and Dairy Technology is one of the prominent and popular disciplines within the technical education in Nepal. Food inspection profession has been helping the world to assure quality food production and it has also been creating salary base employment and self-employment opportunities in public and private sectors. This curriculum is based on the academic requirements to enter bachelor as well as designed with the purpose of producing middle level technical workforce equipped with knowledge and skills related to the field of food and dairy technology so as to meet the demand of such workforce in the country to contribute in the national food quality of Nepal. The knowledge and skills incorporated in this curriculum will be helpful to deliver the individual needs as well as national needs in the field of quality especially in food and dairy sector.

The foundational subjects like English, Nepali, Physics, Chemistry, and Mathematics (offered in diffusion model of curricular programme) are applicable in the technical field. The disciplinary subjects of food and dairy are included in all four semesters. This curricular programme also makes the provision of project works as well as work experience program (WEP*)* in the specific areas, which can be very instrumental in helping the students develop analytical skill and confidence. The curriculum structure and the subject wise content 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 food and dairy industry.

Curriculum title

The tittle of this curricular program is **Diploma in Food and Dairy Technology**

Program Aim

The program aims to prepare mid-level technical human resource equipped with knowledge and skills in Food and Dairy Technology and allied subjects.

Program Objectives

This curriculum has following objectives:

1. Apply the professional knowledge and skills in the respected field of food technology
2. Develop the positive attitudes towards the professions with greater initiative and self-confidence
3. Apply critical thinking for problem-solving and decision making during the service delivery.
4. Follow the quality standards set by the organization for quality assurance of the services offered to the customer.
5. Get employment in governmental, semi-governmental, non-governmental organization as well as other projects and programs.
6. Start their own enterprise and create employment.

Program Description

This course is based on the job required to perform by Technicians at public and private sectors of food science and nutrition-related work. Therefore, this curriculum is designed to provide knowledge and skills on food science and technology related to the occupation. There are six semesters in total within three years. The courses are offered to focus on foundational and core academic subjects of basic science, on basic disciplinary subjects of

food science and technology, and the course also comprises multi-disciplinary subjects applicable in the food and dairy industry, regulatory bodies, I/NGOs in the field of food science and nutrition. Moreover, the third year consists of the application of learned skills and knowledge through the project work and In-plant Training. In brief, the curriculum will guide to produce of competent and highly employable middle-level technical workforces in the field of Food and dairy science.
The contents of each subject prescribed in the curriculum are founded on the "must know and must do" principle. The contents of the curriculum are comprehensively described at the micro-level.

Program duration
The total duration of this curricular program is three academic years [six semesters]. The program is based on a semester system. Moreover, one semester consists of 19.5 academic weeks including an evaluation period. Actual teaching-learning hours 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 interested youths.

Entry Qualification

- SLC or equivalent with compulsory Mathematics, English and Science subjects from a recognized educational institution; or SEE or equivalent with minimum 1.6 CGPA out of 4.0 with compulsory Mathematics, English and Science subjects from a recognized educational institution; or Pre-diploma in Agriculture (Plant Science)/Agriculture (Animal Science)/Food and Dairy or equivalent with minimum 68.33% or as per the provisions mentioned in the admission guidelines of Office of the Controller of Examinations, CTEVT.

- 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 bachelor's degree holders in the related subject area.
- The foundational subjects (core and academic courses) related teachers should be master's degree holders 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, flipcharts, posters, a writing board, etc.
- ***Projected media materials****:* Slides, overhead transparencies, opaque projections, etc.
- ***Audio-visual materials:*** Audiotapes, films, slide-tapes, videodisc, videotapes, etc.
- ***Computer-based instructional materials:*** Computer-based training, interactive video, etc.
- **Web-Based Instructional Materials** (Online learning)
- **Radio/Television/Telephone**
- **Education-focused social media platform**

Teaching learning methodologies

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

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

Approach of Learning

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

Examination and marking scheme

a. Internal assessment

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

b. Final examination

- Weightage of theory and practical marks are mentioned in the 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 teachers must evaluate final practical examinations.
- One evaluator in one setting can evaluate not more than 20 students.
- Practical examination should be administered in an actual situation on a relevant subject with the provision of at least one internal evaluator from the concerned constituent or affiliated institute led by an 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 final examination of each subject to pass the subject.

Provision of back paper

There will be the provision of a back paper but a student must pass all the subjects of all year within six years from the enrollment date; however, there should be a provision of a 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 a review by 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 the institute, threats or assaults to peers, faculty or staff will result in immediate suspension, followed by an administrative review with possible expulsion.

Grading system

The grading system will be as follows:

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

Certificate awarded

- Students who pass all the components of all subjects of all six semesters are considered to have successfully completed the course.
- Students who successfully complete the curricular program will be awarded a degree of **"Diploma in Food and Dairy Technology".**

Career path

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

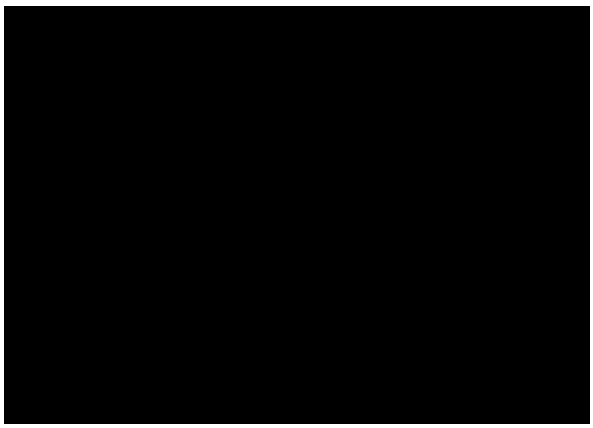
General Attitudes Required

A student should demonstrate the 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:



Offering Departments:

PS: Plant Science
AS: Animal Science
EG: Engineering
CT: Computer Engineering
MG: Management
SH: Science and Humanities
FD: Food and dairy Technology

CURRICULUM STRUCTURE
Diploma in Food and Dairy Technology

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	5	20	60	3	10	10	3	100	
5	AG1105SH	Chemistry I	4	1		2	7	5	20	60	3	10	10	3	100	
6	AG1106SH	Zoology I	4			2	6	5	20	60	3	10	10	3	100	
7	AG1107SH	Botany I	4			2	6	5	20	60	3	10	10	3	100	
		Total	**30**	**3**		**8**	**40**	**33**	**140**	**480**		**40**	40		**700**	

Year/ Semester: I/II

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

Diploma in Food and Dairy Technology

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	AG2101FD	Basic principles of engineering	4		2		6	5	20	80	3	30	20	2	150	*continuous assessment
2	AG2102FD	Principles of food preservation	4		4		8	6	20	80	3	60	40	3	200	
3	AG2103FD	Basic food microbiology	4		4		8	6	20	80	3	60	40	3	200	
4	AG2104FD	Basic principles of fermentation technology	4		4		8	6	20	80	3	60	40	3	200	
5	AG2105FD	Basic statistics	2		2/2		3	3	10	40	1.5	25	-	-	75	
6	AG2106FD	Principles of milk processing	4		3		7	6	20	80	3	60	40	3	200	
		Total	**22**		**18**		**40**	**32**	**110**	**440**		**195**	**180**		**925**	

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	AG2201FD	Food and nutrition	3		1		4	4	20	80	3	25	-		125	*continuous assessment
2	AG2202FD	Indigenous food and dairy products	4		2		6	5	20	80	3	30	20	1.5	150	
3	AG2203FD	Food and dairy chemistry	4		4		8	6	20	80	3	60	40	3	200	
4	AG2204FD	Cereal, bakery and confectionary technology	4		4		8	6	20	80	3	60	40	3	200	
5	AG2205FD	Food and dairy engineering	4		2		6	5	20	80	3	30	20	1.5	150	
6	AG2206FD	Fruit and vegetable technology	4		4		8	6	20	80	3	60	40	3	200	
		Total	**23**		**17**		**40**	**32**	**120**	**480**		**265**	**160**		**1025**	

Diploma in Food and Dairy Technology

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	AG3101FD	Food analysis, safety and quality control	4		3		7	6	20	80	3	60	40	3	200	*continuous assessment
2	AG3102FD	Beverages and spices technology	4		2		6	5	20	80	3	30	20	1.5	150	
3	AG3103FD	Technology of dairy products	4	1	4		9	6	20	80	3	60	40	3	200	
4	AG3104FD	Meat and fish technology	4		4		8	6	20	80	3	60	40	3	200	
5	AG3105FD	Storage and packaging technology	4		2		6	5	20	80	3	30	20	1.5	150	
6	AG3106PS	Agribusiness, Marketing and Cooperative	2		1		3	3	10	40	1.5	25	-	-	75	
		Total	**23**		**17**		**40**	**31**	**110**	**440**		**265**	**160**		**975**	

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	EG3201MG	Entrepreneurship development	3		2		5	4	20	80	3	30	20	1.5	50	*continuous assessment
2	AG3202FD	Project work			11		11	6		-	-	120	80	3	200	
3	AG3203FD	Work Experience Program/In plant training			24		24	12				360	240	4	600	
		Total	**3**		**37**		**40**	**22**				**510**	**340**		**850**	

First Year/ First Semester

नेपाली

११०१ एस.एच.

वर्ष: प्रथम जम्मा: ४ घण्टा/हप्ता

खण्ड: प्रथम 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:-

- आफ्नो व्यावसायिक कार्य क्षेत्रमा प्रभावकारी सञ्चार गर्न
- आफ्नो व्यावसायसँग सम्बन्धित विविध लेखन सीप प्रदर्शन गर्न
- 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 चिह्नहरुको परिचय र प्रयोग सम्बन्धी नियमहरू

१.४ शब्द भण्डार **३ घण्टा**

- स्रोतका आधारमा शब्दको वर्गीकरण
- बनोटका आधारमा
- कार्यका आधारमा

१.५. शब्द रूपायन **२ घण्टा**

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

- क्रियापदको रूपायन

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

- वाक्य संश्लेषण
- वाक्यविश्लेषण

१.७ पदसङ्गति **१ घण्टा**

- पदसङ्गतिको परिचय
- पदसङ्गतिका प्रकार

एकाइ 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 चिठ्ठी
- 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 वाङ्देल
- 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 प्रभावः (छोटो एक अनुच्छेद)
- कृति/पाठको भाषाशैलीः (छोटो एक अनुच्छेद)
- कृति/पाठको कमी, कमजोरी र सुझावः (छोटो एक अनुच्छेद)

३.२ कृति समीक्षा **१८ घन्टा**

क) कथाखण्ड **५ घण्टा**

- हरिदत्तः विश्वेश्वरप्रसाद कोइराला
- बितेका कुराः रुपनारायण सिंह
- मृगतृष्णा: माया ठकुरी

ख) निबन्ध खण्ड **५ घण्टा**

- पहाडी जीवन: लक्ष्मीप्रसाद देवकोटा
- एक पत्र– सम्पादकलाईः शङ्कर लामिछाने
- भान्सा भो हजुरः भैरव अर्याल

ग) कविता खण्ड **४ घण्टा**

- साहित्य सुधा: धरणीधर कोइराला
- हामीः भूपी शेरचन
- नचिनिने भएछौः अगमसिंह गिरी

घ) एकाङ्की **४ घण्टा**

- भावनाः भीमनिधि तिवारी

सिकाइ सामग्रीहरू

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

विशिष्टीकरण तालिका

एकाइ	शीर्षक	समय	पूर्णांक
१	**संचारात्मक नेपाली भाषा र नेपाली व्याकरण**	**१४ घण्टा**	**पूर्णाङ्क (२४)**
	१.१ भाषिक भेदको परिचय १.२ वर्णको परिचय १.३ वर्णविन्यास १.४ शब्द भण्डार १.५ शब्द रुपायन १.६ वाक्य संश्लेषण र वाक्य विश्लेषण १.७ पदसङ्गति	३ घण्टा १ घण्टा ३ घण्टा ३ घण्टा २ घण्टा १ घण्टा १ घण्टा	पूर्णाङ्क (४) पूर्णाङ्क (२) पूर्णाङ्क (४) पूर्णाङ्क (२) पूर्णाङ्क (४) पूर्णाङ्क (४) पूर्णाङ्क (४)
२	**लेखन सीप**	**२२ घण्टा**	**पूर्णाङ्क (३२)**
	२.१ लेखन सीप (बोधको ज्ञान) २.२ लेखन सीप (बुँदा लेखन, सारांश लेखन) २.३ लेखन सीप (संवाद लेखन, अनुच्छेद लेखन)	६ घण्टा ३ घण्टा ३ घण्टा ४ घण्टा	पूर्णाङ्क (८) पूर्णाङ्क (४) पूर्णाङ्क (४) पूर्णाङ्क (४)

	२.४ लेखन सीप (निमन्त्रणा पत्र, सूचना, सम्पादकलाई चिठ्ठी, निवेदन, विज्ञापन, बधाई ज्ञापन) २.५ लेखन सीप (निबन्ध लेखन) २.६ लेखन सीप (प्रतिवेदन लेखन)	४ घण्टा २ घण्टा	पूर्णाङ्क (८) 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 क. कथा खण्ड ख. निवन्ध खण्ड ग. कविता खण्ड घ. एकाङ्की	१८ घण्टा ५ घण्टा ५ घण्टा ४ घण्टा ४ घण्टा	पूर्णाङ्क (१६) पूर्णाङ्क (४) पूर्णाङ्क (४) पूर्णाङ्क (४) पूर्णाङ्क (४)

English I
1102 SH

Year: I **Total: 4 hours /week**
Semester: I **Lecture: 4 hour/week**
Practical: hours/week

Course Description:

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

Course Objectives:

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

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

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

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

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

Unit 2: Family **4 Hrs.**

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

Unit 3: Sports **4 Hrs.**

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

3.4. Asking for and giving reason
3.5. Project Work

Unit 4: Education **4 Hrs.**

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

Unit 5: Humor **4 Hrs.**

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

Unit 6: Hobbies **4 Hrs.**

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

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

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

Unit 8: History **4 Hrs.**

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

8.6 Project Work

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

9.1 Reading Comprehension passage: A Journey Back in Time
  9.1.1 Content Words
  9.1.2 Question - answer
9.2 Business letter
9.3 Miscellaneous agreements
9.4 Pair work: Expressing indifference
9.5 Project Work

Unit 10: Fantasy **4 Hrs.**

10.1 Reading Comprehension: The Romance of a Busy Broker
  10.1.1 Finding meaning in a dictionary
  10.1.2 Terminologies used in the stock market
  10.1.3 Question - answer
10.2 Writing Summary
10.3 Relative Clause
10.4 Describing process
10.5 Project Work

Section Two: Literature **20 Hrs.**

Unit One: Short Stories

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

Unit Two: Poems

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

Unit Three: Essays

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

Recommended Texts:

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

- Maharjan L. B., A textbook of English sounds and Structures, Vidyarthi Pustak Bhandar, Kathmandu,2000.
- Blundell, Jon, Higgens, Jonathan & Middlemiss, Nigel, Function of English, Oxford University Press
- Better English Pronunciation, Cambridge University Press, New edition
- Link English, Central Department of English, Tribhuvan University
- 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.
- The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Final written exam marking scheme

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

Mathematics I

(1103SH)

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

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

Tutorial: 1 hour/week

Practical: hours/week

Lab: hours/week

Course description:

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

Course objectives:

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

- 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 texts:

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

Evaluation Scheme

Unit wise Marks division for Final Exam

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

Physics I

(AG1104SH**)**

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

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

Tutorial: 1 hour/week

Practical: hours/week

Lab: 2 hours/week

Course description

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

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

Course objectives

On completion of the course the students will be enabled 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.

Course Contents:

Theory I

Unit 1. Mechanics: 30 Hrs.

1.1 Units and measurement: 3 Hrs.

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

1.2 Scalar and vectors: 2 Hrs.

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

1.3. Kinematics: 4 Hrs.

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

1.4. Force: 7 Hrs.

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

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

- Definition and units of work, energy and power.
- Potential and kinetic energy.
- Conservative force.
- Law of conservation of energy and its application for falling body.
- Simple numerical problems.

1.6. Gravity and Gravitation: 3 Hrs.

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

1.7. Rotational dynamics of rigid bodies: 2 Hrs.

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

1.8. Hydrostatics: 3 Hrs.

- Fluid pressure and determination of the formula P=ρgh.
- 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 texts:

- Brij Lai and Subramanyan, Principles of physics, *A text book of physics by Satya Prakash Part I & II*
- Nelkon and parker, advanced level physics (5^{th} ed.)
- Shrestha, U. P, Physics Practical Guide
- Shrestha, V.K. Numerical examples in physics Vol. I and II Ratna Pustak Bhandar, Nepal.
- Pradhan J.M. and gupta, S.K, A textbook of physics (part i and ii)
- Verma, H.C, Concepts of physics i &ii
- Sears, Zemansky & young, University physics
- Haliday, D &Resnickm R. Physics Part i &ii

Note: In case of an unavailability of above sources;

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

Final written exam marking scheme

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

Chemistry I

(AG1105SH**)**

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

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

Tutorial: 1 hour/week

Practical: hours/week

Lab: 2 hours/week

Course description:

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

Course objectives:

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

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

Course Contents:

Theory

Unit: 1: General Chemistry: 7 Hrs.

1.1.Symbol:

- Definition
- Significance (qualitative and quantitative)

1.2.Formula:

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

1.3.Chemical equation:

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

Unit: 2: System of Classification: 20 Hrs.

2.1.Atomic structure:

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

2.2.Electronic theory of valency:

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

2.3.Oxidation and reduction:

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

2.4.Periodic table:

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

2.5.Acid, Base and Salt:

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

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

2.6.States of matter-Gaseous state

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

2.7.States of matter-Liquid State

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

2.8.States of matter-Solid State

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

2.9.Solutions-True solution

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

2.10. Mole concept and chemical arithmetic

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

2.11. Environmental Chemistry

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

Organic chemistry **18 Hrs.**

3.1: An introduction to organic Chemistry

- Origin of organic chemistry-Vital force theory and modern theory

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

3.2: Nomenclature of organic compounds

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

3.3: Isomerism

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

3.4: Organic reaction

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

3.5: Hydrocarbons

A. Alkane

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

B. Alkene

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

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

C. Alkyne

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

3.6 Alkyl halides

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

3.7: Alcohol

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

Practical (Laboratory)

1. Simple Glass Working — 6 Hrs.
    a. to cut the glass tube into three equal parts and round up their shape edges
    b. to bore a hole through a cork
    c. to bend the glass tubing into acute, obtuse and right angle
    d. to draw a jet and capillary tube
    e. to fit up a wash bottle
2. Separate sand and common salt in pure and dry states from mixture of sand and common salt. — 2 Hrs.

Separate sand and camphor from a mixture of sand and camphor. — 2 Hrs.

3. Recover the precipitate obtained in pure and dry state when the given solution -A is treated with excess of solution-B — 2 Hrs.
    i. Solution-A= $BaCl_2$
    ii. Solution-B =H_2SO_4
4. Prepare a sample of clearly pure distilled water from impure water and carry out the test for purity of water thus prepared. — 2 Hrs.
5. Prepare a sample of bazaar copper sulphate at laboratory temperature and use the solution to get pure crystals of salts. — 2 Hrs.
6. Obtain sodium chloride by the neutralization of: — 2 Hrs.
    i. Bench of hydrochloric acid with a bench of sodium hydroxide.
    ii. Sodium carbonate with hydrochloric acid
7. Prepare a soluble derivative of barium carbonate and sodium chloride. — 2 Hrs.

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

Recommended Texts:

- A Text book of Chemistry, Jha and Guglani
- Foundations of Chemistry, Vol. 1, M.K. Sthpit and R.R. Pradhananga
- Fundamentals of Chemistry, K.R. Palak
- Inorganic Chemistry, Bahl and Tuli
- A Text book of Engineering Chemistry, R.S. Sharma
- A Textbook of Inorganic Chemistry, L.M. Mitra
- Elementary practical chemistry, M.K Sthapit

Other learning materials:

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

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

Final written exam marking scheme

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

Zoology I

(AG1106SH**)**

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

Course description:

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

Course objectives:

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

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

Course Contents:

Theory [60 Hours]

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

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

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

1.4.5 Taxidermy

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

2.1. Introduction to Cell

2.1.1. Basic structure of prokaryotic and eukaryotic cell

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

2.1.3. Meaning of Cyclosis, endocytosis, exocytosis

2.2. Cell Division

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

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

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

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

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

2.3. Tissues and their types

2.3.1. Definition of tissue and describe its types.

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

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

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

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

2.3.6. Flow chart of types of tissues and its subtypes

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

3.1. Concept of Taxonomy

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

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

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

3.1.4. Basis of classification in different systems

3.1.5. Differences between artificial and natural systems of classification

3.2. Binomial Nomenclature and Classification

3.2.1. Describe the need for scientific nomenclature

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

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

3.2.4. Five kingdom system of classification.

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

Unit 4 Animal phylogeny and classification 12 Hrs.

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

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

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

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

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

5.2. Define evolution and organic evolution

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

5.4. Describe different theories of organic evolution-

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

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

5.5. Geological time period and evolutionary tree of humans

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

Unit 6 Study of Earthworm 5 Hrs.

1.1. Systematic position habit, habitat, external features.

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

1.3. Economic importance of earthworm.

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

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

7.1.1 Honeybee and

7.1.2 Silkworm.

Practical [30 Hrs.]

Unit 1 Use of the microscope 4 Hrs.

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

1.2. Proper handling of microscope.

1.3. Explain the concept of magnification.

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

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

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

2.3. Identification of common birds in agricultural ecosystem

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

2.1. Microscopic observation of permanent slides of animal tissues

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

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

4.1. Dissection of earthworm

4.2. Temporary mount of setae of earthworm

Final written exam marking scheme

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

Botany I

(AG1107SH)

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

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

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

- Demonstrate an understanding of the fundamental principles and concepts of botany.
- Apply taxonomic methods and techniques to categorize and differentiate plant species
- Demonstrate an understanding of molecular biology
- Evaluate the economic significance of plants and their role in maintaining biodiversity and ecosystem balance.

Course Contents:
Theory

Unit 1. Introduction to botany: 3 Hrs.

1.1. Definition and Scope of Botany
1.2. Importance of Botany
1.3. Branches of Botany
1.4. Discuss the relation of Botany with other sciences like Physics, Chemistry, Statistics etc.

Unit 2. Molecular Biology: 11 Hrs.

2.1 Life Components 1 Hr.

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

2.2 Water: 1Hr.

- Structure, properties and biological role of water.

2.3 Carbohydrates: 2 Hrs.

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

2.4 Proteins 2 Hrs.

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

- List functions of proteins.

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

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

Unit 3. Taxonomy and Biodiversity: 41 Hrs.

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

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

3.3 Concepts of Biodiversity: 4 Hrs.
- Define biodiversity.
- Discuss importance of conserving biodiversity.
- Give levels of biodiversity- ecosystem and habitat diversity, species diversity and genetic diversity.
- Give the latest status of biodiversity of Nepal.
- List protected plant species in Nepal.
- Define endemic species and list the endemic species of Nepal.

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

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

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

3.6 Fungi 4 Hrs.

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

3.7 Algae 4 Hrs.

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

3.8 Bryophytes 3 Hrs.

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

3.9 Pteridophytes 3 Hrs.

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

3.10 Gymnosperm 3 Hrs.

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

3.11 Angiosperm 2 Hrs.

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

3.12 Morphology of Angiosperm 4 Hrs.

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

3.13 Study of some Angiosperm families 5 Hrs.

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

Unit 4. Economic Botany: 5 Hrs.

4.1 Food Plants: 2 Hrs.

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

4.2. Medicinal Plant: 2 Hrs.

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

4.3. Concepts of Ethnobotany 1 Hr.

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

Practical (Laboratory) 30 Hrs.

Practical 1: Molecular Biology

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

Practical 2: Taxonomy and Biodiversity

Monera:

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

Fungi:

- Study yeast cells and their budding under compound microscope.

Plantae:

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

Taxonomy of Angiosperms:

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

Recommended Texts:

1. Dutta, A. C. *A Class book of Botany*. Oxford University Press, Calcutta.
2. Pandey, S. N. and P. S. Trivedi. *A Textbook of Botany* (Vol 1). Vikas Publishink House Pvt Ltd, New Delhi, India.
3. Pandey, S. N. and P. S. Trivedi. *A Textbook of Botany* (Vol 2). Vikas Publishink House Pvt Ltd, New Delhi, India.
4. Pandey, B. P. *Taxonomy of Angiosperms.* Chand and Company Ltd, New Delhi, India.
5. Mahat, Ras Bihari, *A text book of Biology part I and Part II*

6. Chaudhary, R. P. *Biodiversity in Nepal Statud and Conservation.* S. Devi, Saharanpur (U. P.), India and Tec press Books, Bangkok, Thailand.
7. Pandey, B. P. *Economic Botany.* S. Chand and Company Ltd, New Delhi, India.
8. Lawerence, C. H. M., *Taxonomy of Vascular Plants.* McMillan Company.
9. Vasishta, P. C. *Botany for Degree Students (vol 5) Gymnosperms.* S. Chand and Company Ltd, New Delhi, India.
10. Jain, J. L. *Fundamentals of Biochemistry.* S. Chand and Company Ltd, New Delhi, India.

Learning materials:

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

Final written exam marking scheme

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

First Year/Second Semester

English II
1201 SH

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

Course Description:

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

Course Objectives:

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

- Construct sensible sentences applying the grammatical structures.
- Answer the questions given after the comprehension passage.
- Use terminologies vocabularies to construct sensible sentences.
- Perform the communicative functions in given situation.
- Write paragraphs on people, place and events correctly and meaningfully.
- 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.**

.1 Reading Comprehension: "I am Sorry"- The Hardest Three Words to Say

.1.1Word formation

.1.2Question-answer

.2 Writing Paragraphs on Steps on making education equal

.3 Connectives

.4 Group work: Criticizing

.5 Project Work

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

7.1 Reading comprehension: Train to Pakistan

7.1.1 Terminologies

7.1.2 Question -answer

7.1.3 Vowels: Monophthongs and diphthongs

7.2 Describing People, place or event

7.3 Past simple, Past continuous, Past perfect, Past perfect continuous tense

7.4 Group work: Making Announcements

7.5 Project Work

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

8.1 Reading Comprehension: A Life of Sound and Silence

8.1.1 Terminologies used in music

8.1.2 Word Stress

8.1.3 Question -answer

8.2 Writing a bibliography.
8.3 Preposition of time
8.4 Group work: Predicting
8.5 Project Work

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

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

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

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

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

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

Section Two: Literature **20 Hrs.**

Unit One: Short Stories

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

Unit Two: Poems

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

Unit Three: Essays

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

Recommended Texts:

- Panday, Ram Kumar. ***Yeti Tells.*** SajhaPrakashan.3rd edition. Kathmandu, 2050.
- **Ancient Tales**.Ed, Lohani, Shreedhar P, Adhikari Rameshwar P and Subedi, Abhi N. Educational Enterprises Pvt Ltd: Kathmandu,1996.
- **Grade 12 English.** Centre for Curriculum Development, Government of Nepal: Sano Thimi, 2077.
- Poudel, R.C., A Manual to Communicative English, K.P. Pustak Bhandar, Kathmandu, 1956/57.
- Shah, B.L., A text book of writing skills in English, First edition Hira Books Enterprises, Kathmandu,

- Fruehling, R. T. and Oldham N. B., Write to the point, McGraw- Hill, Inc. New York NY 10020
- Tayior, G., English conversation practice, 1975.
- Maharjan L. B., A textbook of English sounds and Structures, Vidyarthi Pustak Bhandar, Kathmandu,2000.
- Blundell, Jon, Higgens, Jonathan & Middlemiss, Nigel, Function of English, Oxford University Press
- Better English Pronunciation, Cambridge University Press, New edition
- Link English, Central Department of English, Tribhuvan University
- 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.
- The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Evaluation Scheme

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

Mathematics II

(1202SH)

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

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

Tutorial: 1 hour/week

Practical: hours/week

Lab: hours/week

Course description:

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

Course objectives:

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

- 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 texts:

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

Evaluation Scheme

Unit wise Marks division for Final Exam

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

Physics II

(AG1203SH**)**

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

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

Tutorial: 1 hour/week

Practical: hours/week

Lab: 2 hours/week

Course description

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

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

Course objectives

On completion of the course the students will be enabled 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.

Course Contents:

Theory

Unit 1. Current Electricity: **14 Hrs.**

1.1 Electric Current: 3 Hrs.

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

- Conversion of galvanometer into voltmeter and ammeter.
- Simple numerical problems.

1.2 Resistance and heat: 3 Hrs.

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

1.3. Electromagnetism: 4 Hrs.

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

1.4. Alternating Current: 4 Hrs.

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

Unit 2. Magnetism: 8 Hrs.

2.1 Fundamentals of Magnetism:

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

Unit 3. Heat: 18 Hrs.

3.1. Thermometry: 2 Hrs.

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

3.2. Thermal Expansion: 3 Hrs.

- Linear, superficial and cubical expansion of solids.
- The relations $l_2=l_1[1+ \alpha (\theta_2- \theta_1)]$, $A2=A_1 [1+\beta (\theta_2- \theta_1)]$, $V2=V_1 [1+\gamma (\theta_2- \theta_1)]$.
- Relation between coefficient of linear, superficial and cubical expansion of solids.
- Apparent and real expansion of a liquid.
- Change in density of an object due to change in temperature.
- Anomalous expansion of water and its importance to marine life.
- Use of water cooling and heating purposes.

3.3. Heat Capacity: 3 Hrs.

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

3.4. Hygrometry: 2 Hrs.

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

3.5. Transfer of heat 2 Hrs.

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

3.6. Gases: 6 Hrs.

- Statement of Boyle's law and Charle's law.
- Definition of absolute temperature and absolute Zero.
- Concept of ideal gas equation.
- Know the value of R.
- To state and explain Dalton's law of partial pressure.
- Derivation general formula of work done by gas.
- Definition of internal energy of gas.
- Statement of first law of thermodynamics and its draw backs.

- Definition of Molar and specific heat capacity of a gas.
- Derivation of C_p-C_v= R
- Definition of isothermal and adiabatic changes.
- Derivation of pressure exerted by a gas.
- Explanation for r.m.s. speed.
- Solve related numerical problems.

Unit 4. Modern Physics: **20 Hrs.**

4.1. Electrons: 3 Hrs.

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

4.2. Photo electricity: 4 Hrs.

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

4.3. X-rays: 2 Hrs.

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

4.4. Radioactivity: 4 Hrs.

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

4.5. Properties of nucleus: 4 Hrs.

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

4.6. Physics and society: 3 Hrs.

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

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

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

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

Recommended Texts:

- Brij Lai and Subramanyan, Principles of physics, *A text book of physics by Satya Prakash Part I & II*
- Nelkon and parker, advanced level physics (5^{th} ed.)
- Shrestha, U. P, Physics Practical Guide
- Shrestha, V.K. Numerical examples in physics Vol. I and II Ratna Pustak Bhandar, Nepal
- Pradhan J.M. and gupta, S.K, A textbook of physics (part i and ii)
- Verma, H.C, Concepts of physics i &ii
- Sears, Zemansky & young, University physics
- Haliday, D &Resnickm R. Physics Part i &ii

Note: in case of an unavailability of above sources;

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

Final written exam marking scheme

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

Chemistry II

(AG1204SH**)**

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

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

Tutorial: 1 hour/week

Practical: hours/week

Lab: 2 hours/week

Course description:

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

Course objectives:

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

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

Course Contents:

Theory

Unit 1 Physical Chemistry **7 Hrs.**

1.1: Electrochemistry

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

1.2: Volumetric analysis

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

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

- Normality equations
- Calculations to prepare different concentrations of solution

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

2.1: Water

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

2.2.: Non-metals

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

2.3: Acids and chemical fertilizers

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

2.4: Minerals

- Sources of the 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 NH_3.
- Physical properties of copper, action with H_2SO_4, HNO_3, and short notes on bluevitrol.
- Zinc, physical properties, action with HCl, HNO_3, H_2SO_4, water, air and alkali, galvanization.
- Iron: physical properties action with HCl, HNO_3, H_2SO_4, water, halogen, rusting.

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

3.1: Ether

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

3.2: Carbonyl compound

Lesson A Formaldehyde & Acetaldehyde

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

Lesson B. Acetone (Ketone)

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

3.3: Carboxylic acid Acetic Acid

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

3.4: Amines.

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

3.5: Phenol

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

- Action with Na, Zn, NH_3, benzene diazonium chloride Kolbe's reaction.

3.6: Aromatic Compounds

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

3.7: Natural Products chemistry

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

Practical (Laboratory)

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

Recommended Texts:

- Foundations of chemistry, Vol-2, M.K. Sthapit and R.R. Pradhananga
- A text Book of chemistry, Jha & Guglani
- A text Book of Organic Chemistry, B.S. Bahl & Arun Bahl
- Elementary qualitative analysis, M.K. Sthapit and C.B. Tuladhar
- Elementary practical chemistry, MK. Sthapit
- Inorganic chemistry, Bahl & Tuli
- Elementary Organic Chemistry, P.N. Bargava
- Fundamentals of chemistry, K.R. Palak
- 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 **Total: 6 hours /week**

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

Tutorial: hour/week

Practical: hours/week

Lab: 2 hours/week

Course description:

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

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

Course objectives:

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

- 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

Course Contents:

Theory

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

- Digestive system.
- Respiratory system.
- Circulatory system.
- Reproductive system and
- 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.**

1.1 Definition of learned behavior and inborn behavior
1.2 Definition of reflex action
1.3 Definition of taxis and its types
1.4 Definition of Leadership and the qualities of leader
1.5 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 Texts:

- Ashok K Bam, Bidya Sagar Jha, Janak Raj Subedi, Rup Bahadur Shah, Dhirendra Bahadur Jha- Zoology for Agriculture with Practical, Advance Ayam Publication.
- Keshari Arvind-*A textbook of Zoology for health sciences*, Vidyarthi Pustak Bhandar
- Shrestha Raghubar; Ghimire Suvas Chandra- *United Zoology for health sciences*, United Nepal Publications (P.) Ltd.
- 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.
- Verma P. S., *Practical Zoology (Invertebrate)* – S Chand and Company Pvt. Ltd.
- Verma P. S., *Practical Zoology (Chordate)*, S Chand and Company Pvt. Ltd.
- Sharma Subodh- *A handbook of practical zoology,* Himalaya Book Stall.
- Labh Shyam Narayan- *A Textbook of Practical Biology*, Taleju Prakashan.
- Keshari Arvind, Khaga Raj Ghimire, Bijay Shankar Mishra- *Practical Biology for class XI*, Vidyarthi Pustak Bhandar.
- Prof. Arvind K. Keshari- *A Textbook of Higher Secondary Biology, Vol I & Vol II* Vidyarthi Pustak Bhandar

- Arvind K. Keshari, Khaga Raj Ghimire, Bijay Shankar Mishra & Kamal K. Adhikari- *A Textbook of Higher Secondary Biology, Class XI,* Vidyarthi Pustak Bhandar
- Arvind K. Keshari & Adhikari, K.- *A Textbook of Higher Secondary Biology, Class XII,* Vidyarthi Pustak Bhandar
- Vidyarthi R. D. and Pandey P. N. - *A Textbook of Zoology*, S Chand and Company Pvt. Ltd.
- Majpuria T. C. Modern Approach to Zoology – Pradeep Publications
- Sharma, P.D. - *Ecology and Environment*, Rastogi Publications
- 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 **Total: 6 hours /week**

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

Tutorial: hour/week

Practical: hours/week

Lab: 2 hours/week

Course description:

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

Course objectives:

After completion of this course students will be able to

- Identify and describe the anatomical structures of plants, including roots, stems, leaves, flowers, and fruits, using proper anatomical terminology
- Explain the physiological processes of plants, such as photosynthesis, respiration, and transpiration.
- Explore the applications of biotechnology in plant improvement, genetic engineering, and crop production
- Evaluate the environmental significance of plants and their role in maintaining biodiversity and ecosystem balance.

Course Contents:

Theory

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

1.1: Tissue and its types 8 Hrs.

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

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

- Describe internal structures of dicot and monocot stems.

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

1.3: Secondary growth 2 Hrs.

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

Unit2: Plant Physiology 15 Hrs.

2.1 Diffusion: 3 Hrs.

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

2.2. Osmosis: 3 Hrs.

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

2.3. Transpiration: 2 Hrs.

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

2.4 Photosynthesis 3 Hrs.

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

2.5: Respiration 4 Hrs.

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

Unit 3: Embryology of Angiosperms 10 Hrs.

3.1: Reproduction 3 Hrs.

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

3.2: Pollination 3 Hrs.

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

3.3: Fertilization 3 Hrs.

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

Unit 4: Genetics 5 Hrs.

4.1 Heredity and Variation 2 Hrs.

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

4.2 Mendel's Law of Inheritance 3 Hrs.

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

Unit 5: Biotechnology 8 Hrs.

5.1: Introduction to Biotechnology 3 Hrs.

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

5.2: Plant Tissue Culture 3 Hrs.

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

5.3 Introduction to Plant Breeding 2 Hrs.

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

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

6.1: Ecology 2 Hrs.

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

6.2: Ecological imbalance 4 Hrs.

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

Practical (Laboratory) **30 Hrs.**

Practical 1: Plant Breeding

- Learn basic techniques and processes of hybridization experiments.

Practical 2: Biotechnology

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

Practical 3: Plant Anatomy

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

Practical 4: Physiology

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

Practical 5: Embryology of Angiosperms

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

Recommended Texts:

- Sinha, V. and S. Sinah. *Cytogenetics Plant Breeding and Evolution.* Vikas Publications Ltd, New Deldi.
- 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.
- Keshari, A. K. and K. K. Adhikari. *A text Book of Higher Secondary Biology (Class II).* Vidyarthi Pustak Bhandar, Kathmandu.

- Ranjitkar, H. D. 2005. A Hand Book of Practical Botany. Mr. Arun K. Ranjitkar, Kalanki, Kathmandu.
- Mahat, Ras Bihari, *A text book of Biology part I and Part II*
- Lawerence, C. H. M., *Taxonomy of Vascular Plants.* McMillan Company.
- Bhojwani S. S. and S. P. Bhatnagar. *The Embryology of Angiosperms.* Vikas Publication, Delhi, 1993.
- Dubey, R. C. *A Textbook of Biotechnology.* S. Chand and Company Ltd, New Delhi, India.
- Jain, V. K. *Fundamentals of Plant Physiology.* S. Chand and Company Ltd, New Delhi, India.

Other learning materials:

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

Final written exam marking scheme

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

Computer Application

(EG1211CT)

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

Semester: II **Lecture: 2 hours/week**

Tutorial: hour/week

Practical: hours/week

Lab: 2 hours/week

Course description:

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

Course objectives:

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

- Explain the basic architecture of Computer;
- Identify major components of computer and their role;
- Familiar with the different Operating Systems like MS-DOS, Windows etc.;
- Operate different Software applications;
- Apply the basic networking concept; and
- Apply internet for different purposes.

Course Contents:

Theory

Unit 1. Introduction to Computers: **2 Hrs.**

1.1 History of computers
1.2 Generation of computer
1.3 Types of computer
1.4 Computer hardware and software

Unit 2. Hardware Components: **6 Hrs.**

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

Unit 3. System Software: **6 Hrs.**

3.1 Importance of Operating Systems (OS)
3.2 Types of Operating System
3.3 Functions of Operating System

3.3.1 Memory management
3.3.2 Device management
3.3.3 File management
3.3.4 Processor management
3.3.5 Security

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

3.5 Windows Operating System
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.

Recommended Texts:

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

Evaluation Scheme

Unit wise Marks division for Final Exam

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

Second Year /Second Semester

Basic Principles of Engineering

AG2101FD

Year: II **Total: 6 hours /week**
Semester: I **Lecture: 4 hour/week**
Practical: 2 hours/week
Lab: 0 hours/week

Course Description

The course is designed to conceptualize the basic concept of engineering principles. After completion of this course, student will be able to discuss about basic engineering along with drawings required by food industries.

Course Objectives

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

- Familiarize about unit conversion
- Prepare the simple drawings and understand the basic engineering drawings
- Conceptualize temperature and pressure measuring devices
- Conceptualize basics of electricity, power transmission, steam generating devices, and psychometry.

Theory **60 hrs**

Unit 1: Unit, Dimension, and their conversion **5 Hrs.**

1.1 Concepts of Units and Dimension, Fundamental and derived units, Introduction to various systems of units: MKS and English Units, Unit conversion exercise with special reference to SI system

Unit 2: Basic engineering drawing **5 Hrs.**

2.1 Elementary idea of drawing objects: Definition, types and uses, introduction to tools and materials used.

Unit 3: Fluids **4 Hrs.**

3.1 Fluids, compressible and incompressible fluids, Shear stress and shear rate, viscosity, Newton's law of viscosity, Newtonian and non-Newtonian fluids and their types

Unit 4: Steam and steam generation devices **8 Hrs.**

4.1 Specific heat capacity, Sensible and latent heat, the phase diagram of water, Calculation of energy needed to generate steam, Wet, dry, and superheated steam, Boilers: boilers utilities and accessories, Water tube and fire tube boilers, their relative merits and demerits

Unit 5: Psychrometry **8 Hrs.**

5.1 Air and its composition, definitions, and a general understanding of psychrometric properties: dry bulb temperature, wet bulb temperature, humidity ratio, relative humidity, dew point temperature, specific volume, psychrometric chart, psychrometric processes, and application to find psychrometric properties of air. Application of psychometry in food processing

Unit 6: Simple electrical principle **8Hrs.**

6.1 Simple electrical principles: AC and DC, Faraday's law, single phase and 3-phase, transformers, fuse, switches, insulators, and insulation materials, Fleming's rule, electrical motors, motor controller, generators and dynamo, power factor.

Unit 7: Simple Mechanical principles and power transmission **8 Hrs.**

7.1 Concepts of velocity, acceleration, energy, momentum, force, power

7.2 Working principles and industrial applications of mechanical power transmission: belt drive, gear drive, chain drive, and their application

7.3 Structure and function of Bearings, coupling, shaft, and cranks

Unit 8: Refrigeration **6 Hrs.**

8.1 Principles of refrigeration, Units of refrigeration (calculation of tonnes of refrigeration), different types of refrigeration (vapor compression and vapor absorption), introduction, types and desirable properties of refrigerants, Application of refrigeration system in food industries

Unit 9: Liquid Pumping devices **2 Hrs.**

9.1 Types of pump: Centrifugal pump, gear pump, and reciprocating pump and their uses

Unit 10: Measurement devices(Working principle and their uses) **6 Hrs.**

10.1 Temperature: Glass thermometers, resistance thermometers (thermistors and resistance thermal detector, RTD), pyrometer

10.2 Concept of pressure and hydrostatic pressure, gauge and absolute pressure, mechanical manometer (bourdon gauge tube, diaphragm) liquid in tube manometers (piezometer, simple-tube manometer, differential manometer), and calculations

Practical (Laboratory) **Total:30hrs**

1. Perform Unit conversion 4hrs.
2. Perform working principle of electric motors and electric generators and carrying out their simple drawing 2 hrs
3. Use the psychrometric chart to solve psychrometric properties of air 4 hrs.
4. Work on the refrigeration system and simple schematic drawing 4 hrs
5. Visit Industry (Dairy and beverage industry) and write report (main objective is to learn about measuring devices, pumps, refrigeration systems, boilers, power transmission systems 16 hrs

Recommended Texts:

- S.C. Aror & S. Domkundwar, A course in Refrigeration and air-conditioning. Dhanpat Rai & Co. (Pvt.) Ltd., Delhi.
- P.K. Nag Engineering Thermodynamics, Tata McGraw Hill Publishing CO: Ltd., New Delhi. I .
- S.B. Mathur and S. Domkundwar, Mechanical Engineering, Dhanpat Rai & Sons Delhi.
- N.D. Bhatt. Elementary Engineering Drawing
- A. Ghimire, Basic principle of engineering.

Principles of Food Preservation

AG2102FD

Year: II **Total: 8 hours /week**
Semester: I **Lecture: 4 hour/week**
Practical: 4 hours/week
Lab: 0 hours/week

Course Description

This course provides the theoretical as well as practical knowledge to the students in food preservation. After completion of this course, students gain knowledge about the underlining principles of basic food preservation methods such as dehydration, drying, freezing, canning, irradiation, and preservation by natural and chemical preservatives. This course also includes history of food preservation, microbial preference for spoilage, and food deterioration.

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, learn food preservation techniques and apply their knowledge in food industries.

Course Objectives

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

- Explain the basic principles of food preservations
- Explain the conventional methods of food preservations
- Explain factors affecting and process of food spoilage
- Describe mechanism of drying and process of dehydration
- Define cellar storage, chilling storage and types of chilling storage.
- Explain the freezing procedures of food items.
- Describe history of thermal processing of foods,
- Describe heat resistance of microorganisms and factors affecting heat resistance.
- Describe aseptic technology (canning, bottling, tetra packaging) and spoilage of packed foods.
- Explain irradiation technology, generation of ionizing (with terminologies and its units)
- Explain types of preservatives with examples and mode of action on microorganisms
- Explain the basic concepts of minimal processing and hurdle technology

Course contents

Theory **60 hrs**

Unit 1: Introduction and historical development of food preservation 2 hrs.

1.1 Definition of Food Preservation
1.2 History of microbial spoilage of food
1.3 Historical development of canning, bottling, freezing, drying and irradiation of food.
1.4 Historical development of Pasteurization and canning processes

Unit 2: Food spoilage and its types and factors responsible 6 hrs

2.1 Definition of food spoilage
2.2. Types
2.2.1 By microorganisms (bacteria, fungi: yeasts, molds)

2.2.2 Enzymatic food spoilage
2.2.3 Spoilage by chemical reaction
2.2.4. Spoilage by pests
2.3 Intrinsic and extrinsic factors of food spoilage

Unit 3: Food preservation by Drying and Dehydration 6 hrs.

3.1 Definition of moisture content and water activity along with formula
3.2 Table illustrating moisture content of foods
3.3 Differences between drying and dehydration
3.4 Movement of moisture during drying and drying curve
3.5 Illustrate general drying operations
3.6 Hot air driers (Hot air oven, Tunnel and cabinet), heated surface driers (Drum drier), freeze drying and solar drying

Unit 4: Food preservation by low temperature and minimal processing 14hrs**.**

4.1 Principle of food preservation by low temperature
4.2 Principle and uses of cellar storage
4.3 Temperature range of chilling storage for different commodities
4. 4 Description of chilling effects on microbial growth
4.5Definition, principle and figurative explanation of freezing a typical type of food
4.6 Differences between quick freezing and slow freezing
4.7 Classification of freezing equipment-mechanical freezer and cryogenic freezer
4.8 Effects of freezing on microbial growth
4.9 Freezing rate and its effect on quality of food
4.10 Effects of freezing and frozen storage,
4.11 Definition and methods of thawing
4.12 Flowcharts of freezing peas, carrot and meat
4.13 Tabulation of shelf life of common foods in refrigeration and freezing temperatures,
4.14 Concepts of minimal processing of foods
4.15 Modified atmospheric storage (MAS) and Controlled atmospheric storage (CAS)

Unit 5: Food preservation by Thermal processing 16 hrs.

5.1 Introduction of food preservation by thermal processing
    5.1.1 Principle of food preservation by high temperature
5.2 Introduction to different forms of heat treatment
    5.2.1 Definition of Pasteurization and sterilization and aseptic technology
    5.2.2 Description of aseptic caning
    5.2.3 Advantages of aseptic canning over conventional canning
    5.2.4 Process flowchart of aseptic canning system (Dole Process)
5.3 Introduction to factors affecting extent of heat treatment
    5.3.1 Explanation of factors: heat resistance of microorganism, pH of food, heating conditions, thermo-physical properties of food, shape and size of container and storage conditions after processing.
5.4 Classification foods on the basis of pH and their nature
    5.4.1 On the basis acidity (low, medium, high) acidity
    5.4.2 Perishable and non-perishable foods
5.5 Describe heat resistance of microorganisms
    5.5.1 Heat resistance of thermophiles, mesophiles and psychrophiles
5.6 Introduction to containers of canning foods
    5.6.1 Introduction and ideal properties of Canning and Bottling containers

5.7 Describe types of containers
- 5.7.1 Explanation of metal containers (desirable properties of metal cans, process of can seam formation, lacquering and its types-acid resistant lacquer and sulfur resistant lacquer)
- 5.7.2 Description of glass containers, aluminum containers and flexible pouches (Types, heat liability, product compatibility, handling and storage properties)
- 5.7.3 Types of processing equipment's Introduction of retort Description of batch retort, craterless retort and agitating retort

5.8 Explain heat penetration in canned foods
- 5.8.1 Description of heat transfer in cans by conduction and convection
- 5.8.2 Factors influencing heat penetration
  - -Types of food products
  - -Size, shape , head space and agitation of container,
  - -Heating of cans by -saturated steam, hot water, flame and temperature of the retort

5.9 Measurement of sterility and determination of process time
- 5.9.1 Definition of thermal death time (TDT) and thermal death point (TDP)
- 5.9.2 Definition of
  - -D value
  - -Z value
  - -F value

5.10 Spoilage of canned foods
- 5.10.1 Description of spoilage
  - 5.10.1.1 Physical and chemical spoilage
  - 5.10.1.2 Over filling
  - 5.10.1.3 Under exhausting
  - 5.10.1.4 Foreign flavors
  - 5.10.1.5 Corrosion of cans
  - 5.10.1.6 Paneling
  - 5.10.1.7 Damage due to rough handling
  - 5.10.1.8 Discoloration due to chemical changes
- 5.10.2 Microbiological spoilage (Preprocessing spoilage, under processing, After processing)
- 5.10.3 Description of blown cans (flat, flipper, springer, soft swell, hard swell).

Unit 6: Food preservation by Irradiation 10 hrs.

6.1 Definition of irradiation and electromagnetic radiations
Concept of electromagnetic spectrum

6.2 Introduction to ionizing radiation
- 6.2.1 Conceptualization of α(alpha) particles, β(beta) particles and ϒ(gama) radiations

6.3 Definition of terms and units
- 6.3.1 Conceptualization of Radappertization, Curie, Becquerel, rad and Grays
- 6.3.2 Definition of radiation dose

6.4 Explain generation of ionizing radiation
- 6.4.1 Conceptualization of radioactive sources, machine sources

6.5 Introduction to scope of irradiation in food processing
- 6.5.1 Introduction and scope of irradiation in food processing,
- 6.5.2 Irradiation effects on microorganisms

6.6 Explain quality of irradiated foods
- 6.6.1 Merits and demerits of irradiation in quality of food, applicable irradiation doses in food.

Unit 7: Food preservation by preservatives 6 hrs.

7.1 Definition and description of preservatives

7.2 Types of preservatives

7.2.1 Class I preservatives

7.2.2 Class II preservatives

7.3 Natural preservatives used in foods

7.3.1 Mode of action of : (sodium chloride ,sugars , ethanol, acetic acid, wood smoke, spices and essential oils

7.4 Chemical preservatives used in food (benzoic acid, Sulphur dioxide and) nitrates, nitrites, and Dose and their mode of action.

7.5 Introduction to hurdle technology in food preservation

7.5.1 Definition and basic concept of hurdle technology and its use in food preservation

PRACTICAL

Total Hours: 60hrs

1. Determine the moisture content of different foods like biscuit, cereals, flour, dough and legumes. 8hrs
2. Observe the thermally processed apple/ pineapple/ mango/mushroom cans 8hrs
3. Determine the blanching time of the given fruits and vegetables performing two tests: peroxidase test and Catalase test 8hrs
4. Determine the pH of given food samples 8hrs
5. Determine D value of microorganism in thermally processed can 8hrs
6. Calculate and determine F value of microorganism in thermally processed cans 8hrs
7. Observation of refrigerated and frozen storage of meat/fish/and other frozen food 6hrs
8. Carry out drying and dehydration of fruits and vegetables 3hrs
9. Perform shelf life study of fruits and vegetables 3hrs

Recommended Texts:

- Principles of Food Preservation – Ganga P. Kharel and Fumio Hashinaga
- The technology of Food Preservation – N.W .Desrosier and J.N Desrosier
- Food Science – N.N. Potter

Final written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	**Total**
Unit Hours	2	6	6	14	16	10	6	**60**
Marks	3	8	8	18	21	14	8	**80**

Basic Food Microbiology

AG2103FD

Year: II **Total: 6 hours /week**
Semester: I **Lecture: 4 hour/week**
Practical: 4 hours/week
Lab: 0 hours/week

Course description

The course covers all the basic aspects of microbiology and food microbiology. This includes historical development of microbiology, scope, classification and culture of microorganisms, exploitation of useful microorganisms, and control of pathogenic/undesirable/spoilage ones.

Course objectives

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

- Identify microbes present in food and allied environment
- Perform culturing, preservation and sterilization procedures
- Conduct isolation, characterization and enumeration of yeasts, bacteria and molds

Theory

Unit 1. Historical development 4**hrs.**

1.1. Chronology of developments, Spontaneous generation, Edward Jenner (Cow Pox), Germ
1.2. Theory of disease
1.3. Pasteur's Experiment, Koch's postulates, Antiseptic Surgery/ Milk Fermentation (Joseph Lister)
1.4. Sterilization (John Tyndall)

Unit 2: Scope and Application of Microbiology **5hrs**

2.1. Food Microbiology, Factors affecting Microbial growth in food, Sources of Microorganisms in food, Foodborne illness and Food Spoilage, Fermented Foods and Food Preservation
2.2. Industrial Microbiology, Fermentation in Industry and Major products of Industrial Microbiology
2.3. Environmental Microbiology- Soil, Water, Air
2.4. A brief introduction to Medical Microbiology, Epidemiology, Mode of Transmission

Unit 3: Classification of microorganisms **3 hrs.**

3.1. Classification, Nomenclature, and Identification
3.2. Major characteristics used in microbial taxonomy
3.3. Methods of classification

Unit 4: Microscopy **6 hrs.**

4.1. Types and sub-types of microscopes (light and electron)
4.2. Preparation for light microscopy
   i) Hanging Drop Preparation
   ii) Wet Mount
   iii) Dry and Fix Method

4.3.Microbiological staining methods

i) Types, Principles, Preparations and Procedures
ii) Gram Stain, Ziehl Nielsen Stain, Negative Staining, Endospore Staining

Unit 5: Structure and functions of prokaryotic cells and Eukaryotic Cells 4hrs.

5.1. Size, Shape and Arrangement of prokaryotic cells
5.2. Cell wall, cytoplasmic membrane, membrane transport systems
5.3. Cytoplasm, cytoplasmic inclusions and vacuoles, cytoskeleton
5.4. Structure and germination of endospore, microbial locomotion
5.5. An overview of difference between prokaryotes and eukaryotes

Unit 6: Microbial growth and nutrition 10hrs.

6.1.Modes of cell division
6.2.Microbial Growth
6.3.Growth curve
6.4.Growth Rate and Generation Time
6.5.Calculation of generation time
6.6.Synchronous Growth
6.7.Continuous Culture

- Chemostat
- Turbidostatic

6.8.Diauxic growth
6.9.Quantitative measurement of growth
Methods for Measurement of Cell Mass

- Direct microscopic count
- Electronic enumeration of cells
- Plate count method
- Membrane filter count method
- Turbidity measurement methods
- Determination of Nitrogen content
- Determination of dry weight

Measurement of specific chemical changes
6.10Common Nutrient Requirements and Nutritional Types of Microorganisms
6.11Types and Composition of Microbiological Media

- Composition of commonly used media
- Plating and streaking techniques
- Environmental factors affecting growth of microorganisms
- Classification of microorganisms on the basis of growth temperature
- Classification based on oxygen requirements
- Growth of microorganism at different pH
- Growth of Organism at different osmotic effects

Unit 7: Factors affection growth of microorganisms 3hrs.

7.1.Physical agents (heat, pH, water activity, oxygen, irradiation, etc.)
7.2.Chemical agents (preservatives, antiseptics and disinfectants) Concept of hurdle technology
7.3.Botulinum cooks

Unit 8: Aseptic operation 3hrs.

8.1.Definitions (asepsis, antisepsis and disinfection)
8.2.Techniques (sterile zone, aseptic pipetting, plating and inoculation, disinfection of working table)

Unit 9: Identification of microorganisms **3hrs.**

Diagnostic features (morphology, colony characteristics, biochemical differentiation, staining reactions)

Unit 10: Microbiology of food, water and air **4hrs.**

10.1.Natural flora of meat, fruits and vegetables, eggs, spices and milk
10.2.Spoilage organisms
10.3.Pathogens in food (*Aspergillus flavus*, *Salmonella, Clostridium botulinum, Listeria*, *Mycobacterium*, etc.)
10.4.Groups of Water Organisms
10.5.Different Sampling Methods
10.6.Index- and indicator organisms and their significance

Unit 11: General principles underlying food spoilage **5 hrs.**

11.1.Differentiation between food deterioration and food spoilage
11.2.Differentiation between food spoilage and defects
11.3.Examples of food spoilage (meat, dairy, fruits and vegetables)
11.4.Principles of methods used to prevent food spoilage (physical, chemical, hurdles.)

Unit 12: Food borne illness **6 hrs.**

12.1. Definitions of food-borne illness, food infection, food intoxication, food toxico-infection and their examples
12.2. Description of common food-borne illnesses (salmonellosis, staphylococcal poisoning, botulism, aflatoxicosis, shigellosis.)
12.3. Preventive measures
13.4. Identification of causative agents

Unit 13: Principles of sanitation and hygiene **4 hrs.**

13.1.Definitions of sanitation and hygiene
13.2.Cross-contamination
13.3.Sources of contamination and preventive measures
13.4.Sanitizing agents and their use in food establishment
13.5.Design of food establishment (layout, piping, waste treatment
13.6.Waste water treatment and disposal

PRACTICAL
Total hours: 60hrs

1. Make labeled drawings of the equipment/glassware 2hrs
2. Operate autoclave 2hrs
3. Operate hot air oven 2hrs
4. Operate vortex mixer 2hrs
5. Use colony counter 1hrs
6. Use pH meter 1hrs
7. Use electronic balance 1hrs
8. Use microscope 3hrs
9. Handle Petri plates 1hrs

10. Handle inoculating loops and needles (including sterilization by incineration) 2hrs
11. Familiarize the label information 1hrs
12. Prepare media (PDA and NA) 1hrs
13. Sterilize media 2hrs
14. Store or plate out media 1hrs
15. Practice aseptic plating techniques 2hrs
16. Prepare smear 2hrs
17. Prepare negative stain (using nigrosine) 2hrs
18. Observe cells under oil-immersion objective 1hrs
19. Record the cell morphology 2hrs
20. Calibrate ocular micrometer 2hrs
21. Measure cell size (length and breadth) 1hrs
22. Observe cell organization and other details (e.g., budding in yeast) 1hrs
23. Exercise statistical analysis (mean and standard deviation using computer) 2hrs
24. Prepare food sample 2hrs
25. Carry out serial dilution 1hrs
26. Count colony forming units 1hrs
27. Exercise using formula for calculating the cell number 2hrs
28. Prepare the suitable dilution 1hrs
29. Prepare the slides for examination 2hrs
30. Exercise on back-calculation 2hrs
31. Prepare the sample (aseptic) 1hrs
32. Perform preparation and plating of media 2hrs
33. Express the result of aseptic inoculation 1hrs
34. Prepare the tape culture 2hrs
35. Observe the morphology at 10×, 20×, and 40× objectives 2hrs
36. Draw/take photographs of molds as seen in the microscope 2hrs
37. Compare characteristics with standard figures for identification 2hrs

Recommended Texts:

- Hogg, S. (2013). Essential Microbiology. 2nd Edition. John Wiley-Blackwell Publication, England
- Kumar, S. (2016). Essentials of Microbiology. Jaypee Brothers Medical Publishers (P) Ltd. Bhotahity, Kathmandu
- Montville, T.J., Matthews, K.R. and Kniel, K.E. (2008). Food Microbiology: An Introduction. 2nd Edition. ASM Press, Washington
- Goldman, E. and Green, L.H. (2009). Practical Handbook of Microbiology. 2nd Edition. CRC Press, New York
- Rai, B.K. (2007). Basic and Food Microbiology. Lecture Manual (self-archived)
- Rai, B.K. and Limnu, D.K. (2016). Basic Practical Manual on Industrial Microbiology. Lulu Publ. USA.

Final written Exam Marking Scheme

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

Basic Principles of Fermentation Technology

AG2104FD

Year: II **Total: 8 hours /week**
Semester: I **Lecture: 4 hour/week**
Practical: 4 hours/week
Lab: 0 hours/week

Course description

The course explores exploitation of microorganisms for the production of industrial food products such as fermented foods and beverages. The course provides insight into desirable properties of industrially important microorganisms and their commercial and traditional uses for the production of a wide range of foods and beverages. At the conclusion, effluent treatment is also covered.

Course objectives

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

- Perform different types of fermentation processes and fermenters.
- Provide skills on preservation and maintenance of industrially important cultures.

Course Contents

Theory **60 hrs**

Unit 1: Scope and importance of fermentation technology **2hrs**

1.1 Importance of fermentation technology in food
1.2 Classification of fermented foods based on substrate type, oxygen requirements, microbes used

Unit 2: Industrial application of microorganisms **4hrs**

2.1 Stoichiometry of fermentation
2.2 Desirable properties of commercial microorganisms for fermentation
2.3 Use of microorganisms for food, feed, and beverage production

Unit 3: Traditional Fermented foods **8hrs**

Microbiology, Process, Ethnic value: Gundruk, Sinki, Khalpi, Tama/Mesu, Jand, Kinema

Unit 4: Concept of fermentation and fermenter **10hrs**

4.1 Fermentation kinetics (Type-I, Type-II, and Mixed Type) with relevant examples
4.2 Fermenter Design consideration with its component and its uses
4.3 Types of fermentation system:

- Batch, fed-batch, and continuous
- Submerged and Solid-state fermentation
- Aerobic and anaerobic

4.4 Relation of growth kinetics with product formation

Unit 5: Production of ethanol **8hrs**

5.1Overview of the processes used for ethanol production from molasses
5.2 Batch fermentation process using blackstrap molasses as the substrate
5.3 Yeast culture and its maintenance
5.4 The distillation operation

5.5 Concept of congeneric and non-congeneric distillates
5.6 Proof and proof spirit
5.7Industrial spirit

Unit 6: Production of beer **8hrs**
6.1 Definition, classification, and general composition
6.2 Description of raw materials (malt, hops, adjuncts, yeast, and water)
6.3 The malting process
6.4 Production of lager beer and Ale beer (major steps)
6.5 Special types of beer (Indian pale ale, Pale ale, pilsner, stout)-definition and difference
6.6 Technical terms used in a brewery
6.7 Defects/spoilages of beer

Unit 7: Production of distilled spirits 6hrs
7.1 Whisky production (major steps)
7.2 Rum production (major steps)
7.3 Brandy production (major steps)
7.4 Vodka and gin production (major steps)
7.5 Raksi technology: Traditional production method, improvement options, and composition

Unit 8: Production of wine **8hrs**
8.1 Definitions and classification of wine
8.2 Production of red table wine (major steps)
8.3 Production of white table wine (major steps)
8.4 Production of fortified wine (major steps for sherry)
8.5 Production of sparkling wine (the champagne process)
8.6 Defects/spoilages of wine

Unit 9: Effluent treatment **6 hrs.**
9.1 Waste treatment: Principle and Importance
9.2 DO, BOD, COD: Definition, Importance, and relation
9.3 Types of effluent treatment systems (activated sludge-, trickling filter, lagoon process, and anaerobic
digestion)
9.4 Basic waste handling process in the dairy, alcoholic, fruits, and vegetable processing industry

PRACTICAL
Total Hours 60
Fermentative yeasts from a starter culture (Morcha) **5hrs.**

- Prepare enrichment culture
- Microscopic examination
- Spread-plate isolation of yeast
- Test fermentation of yeast
- Subculture of potential cells

Amylolytic molds from starter culture (Morcha) **5hrs**

- Growth of molds by planting Morcha specks on a media plate
- Tape culture for examination
- Test liquefaction in cooked rice

- Subculture (by hypheal tip method) and storage of the molds with high amylolytic potential

Red table wine and white wine **10hrs**

- Must treatment (sugar and acid adjustment)
- Pitching rate calculation and pitching
- Primary fermentation
- After-fermentation
- Pasteurization
- Determination of alcohol content and acidity
- Sensory analysis

Ethanol production from molasses **5hrs**

- Prepare molasses medium for fermentation (also conduct calculation drill)
- Pitching rate calculation and pitching
- Recording of fermentation rate (TSS trend)

Single-column distillation and preparation of rum **5hrs**

- Separation of cuts
- Collection of main cut (up to 50% abv)
- Measurement/adjustment of alcohol content (using alcohol meter)
- Preparation of caramel and applying the color
- Bottling and labeling of rum

Preparation of beer **5hrs**

- Malt milling
- Decoction mashing
- Adjunct level calculation
- Wort boiling and hopping
- Cooling, aeration, and pitching
- Fermentation
- Sensory analysis (taste, smell, color, turbidity, alcohol content)

Preparation of gundruk, sinki, khalpi, sauerkraut **10hrs**

- Preparation of vegetables (coring, shredding)
- Fermentation
- Sensory analysis (sourness, flavor, crispness)
- Chemical analysis (acidity and pH)

Drawing a layout of the fermenter **5hrs**

- Layout of fermenter
- Study of different components and their function

Determination of characteristics of sewage **5hrs**

- Determine DO of wastewater from the industry
- Determine BOD of wastewater from the industry
- Determine COD of wastewater from the industry

Recommended Texts:

- Rai, B.K. (2012). Essentials of Industrial Microbiology. Lulu Publishing, USA
- Bamforth, C.W. (2005). Food, fermentation and microorganisms. Blackwell Publishing. U.K.
- McNeil, B. and Harvey, L.M. (2008). Practical Fermentation Technology. John Wiley & Sons. England

- Stanbury, P.F., Whitaker, A. and Hall, S.J. (2003). Principles of Fermentation Technology, 2 nd Edition. Butterworth-Heinemann. London
- Waites, M.J., Morgan, N.L., Rockey, J.S. and Higton, G. (2001). Industrial Microbiology: An Introduction. Blackwell Science Ltd.
- Okafor, N. (2007). Modern Industrial Microbiology and Biotechnology. Science Publishers. USA
- Kharel, G., Acharya, P.P. and Rai, B.K. (2010). Traditional Foods of Nepal. Highland Publishers,

Final written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	8	9	Total
Unit Hours	2	4	8	10	8	8	6	8	6	**60**
Marks	2	5	11	13	11	11	8	11	8	**80**

Basic Statistics

AG2105FD

Year: II **Total: 3 hours /week**
Semester: I **Lecture: 2 hour/week**
Practical: 1 hours/week
Lab: 0 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:
On completion of the course the students will be enabled to:

- Understand the concept of fundamentals of statistics;
- Explore elementary statistical methods to collect, organize, present and interpret agricultural data in a scientific way;
- Distinguish between descriptive statistics and inferential statistics;
- Apply statistical methods through computer application to describe, and analyze agricultural data to draw inferences about the population and
- Manage agricultural data for their future use.

Course Contents:
Theory **30 hrs.**

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 and its application

8.2. Concept of regression, its application and simple linear regression

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: Statistical Quality Control **10 hrs.**

10.1. Familiarize and define Quality, types of characteristics of quality, Control, Quality control, various aspects of quality control, Quality variation and causes, Statistical Quality Control, Process Control,

10.2. Control Chart- merits, objectives and rational subgroups

10.3. Types and Techniques of Control Chart, Control Charts for Mean, Standard Deviation and Range, Interpretation of control charts

10.4. Familiarize about different control charts for attributes through illustration and their interpretation

10.5. Familiarize and define Acceptable quality level (AQL), Lot tolerance percent defective (LTPD), Process average fraction defective, Consumer's risk, Producer's risk, Sampling Inspection by Attributes, Benefits of Sampling Inspection, Validity of Sampling

10.6. Acceptance Sampling by Attributes, Acceptance Plan, Characteristic of acceptance plan

10.7.Sampling Inspection by Attributes, Single Sampling Plan, Double Sampling Plan,

PRACTICAL

Total Hours:15hrs

1. Draw bar diagrams and pie chart. 2hrs
2. Draw Histogram, frequency polygon, frequency curve and Ogive. 2hrs
3. Compute mean, median, mode for grouped data. 2hrs
4. Compute quartile deviation, average deviation, standard deviation. 2hrs
5. Draw the curves and compute skewness of the data. 2hrs
6. Find out the relation between the variables (simple correlation and regression of two variables). 2hrs
7. Compute simple probabilities of events; (sum of events, compound events); Simple problems related to binomial theorem/Poisson distribution. 3hrs

Recommended Texts:

- Agrawal B.L. 1996. Basic statistics (3rdedition), New Age International Pvt. Ltd. New Delhi.Chandel, S.R.S. 1984. A hand book of agricultural statistics. Achal Prakashan Mandir, Kanpur, India.
- 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.
- Dhakal, C.P. 2013. Elementary Statistics in Agriculture and Environmental Sciences. Sajha Prakashan. Lalitpur, Nepal.
- 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.
- Tripathi, P.N. 1991. A manual on introductory agricultural statistics, Tribhuvan University, IAAS, Chitwan, Nepal.
- B.C. Bajracharya A Text book of Statistics
- H.C. Saxena Elementary Statistics
- S. Mrigendralal Statistical Methods
- B.K. Mahajan Method of Biostatistics

Final written Exam Marking Scheme

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

Principles of Milk Processing

AG2016FD

Year: II **Total: 7 hours /week**
Semester: I **Lecture: 4 hour/week**
Practical: 3 hours/week
Lab: 0 hours/week

Course Description

This course is designed to provide students with a comprehensive understanding and practice of the principles, techniques, and processes involved in the production and processing of milk and milk hygiene. This course covers various aspects, including milk collection, quality control, pasteurization, homogenization, separation, and organization involved in milk processing and marketing. Students will gain practical knowledge through hands-on training, laboratory exercises, and industry visits, enabling them to develop the skills necessary for a successful career in the milk processing industry.

Course objectives

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

- Understand the fundamentals of milk composition, properties, and nutritional value.
- Explore the various stages of milk processing, from collection to final product distribution.
- Ensure product safety and hygiene.
- Familiar with the homogenization process
- Familiar with clean milk production process
- Develop an understanding of the regulatory and legal requirements governing milk processing operations.
- Familiar with organization involved in milk processing and marketing

Course Contents:

Theory

Unit 1. Milk: **4 hrs.**

1.1 Definition of Milk
1.2 Gross Composition and Comparison (Cow, Buffalo, Human)
1.3 Factors affecting composition of milk.
1.4 Milk quality test and Importance

- Platform test,
- Payment test,
- Adulteration test,
- Milk grading

Unit 2. Milk Secretion: **4 hrs.**

2.1 Overview of milk secretion in alveoli
2.2 Factors affecting milk yield: Genetic Factor and environmental Factor

Unit 3. Organization involves in Milk Business: **2 hrs.**

3.1 National Dairy Development Board (NDDB)
3.2 Milk Producers' Cooperatives (MPCs)
3.3 Central Dairy Cooperative Association Limited Nepal (CDCAN)

3.4 Provincial Dairy Development Board (PDDB)

Unit 4. Clean Milk Production: 7 hrs.

4.1 Introduction to Clean Milk production
4.2 Sources of Contamination: Animal, Milking man or Machine, Milking vessel, Milk shed or Environment
4.3 Milking methods: Hand milking (Stripping, Full hand milking, Knuckling) and Machine milking; Correct milking procedure
4.4 Importance of cleaning in milking
4.5 Route of microorganism in milk and their activity
4.6 Quality degradation of milk by microorganism

Unit 5. Milk hygiene and public health 6 hrs.

5.1 Microflora of milk: Psychotropic, Psychrophilic, Mesophilic, Thermophilic and Thermoduric microflora
5.2 Prevention and control of microflora contamination in milk
5.3 Abnormal milk: Mastitis milk and Chemical contaminants (antibiotic, pesticides, Mycotoxins and chemical contaminants)
5.4 Milk preservation by chilling, hydrogen peroxide and LP systems
5.5 Milk borne diseases: Bacterial (Tuberculosis) and Viral (Polio myelitis)

Unit 6. Transportation of milk 4 hrs.

6.1 Introduction to Modes of milk transport
6.2 Reception of milk
6.3 Platform tests
6.4 Problems of milk collection and transportation in Nepal

Unit 7. Processed Milk for Liquid Consumptions 16 hrs.

7.1 Introduction to milk for liquid consumption
7.2 Filtration and Clarification of milk
7.3 Cream separation of milk
7.4 Standardization of milk
7.5 Homogenization of milk
7.6 Pasteurization of milk
- Batch or Low Temperature Long Time (LTLT) method
- Continuous or High Temperature Short Time (HTST) method

7.7 Sterilization of milk
7.8 Ultra-High Temperature (UHT) processing of milk

Unit 8. Special milk 6 hrs.

8.1 Introduction to Special milks
8.2 Recombined milk
8.3 Reconstituted milk
8.4 Filled milk
8.5 Vitaminized milk
8.6 Flavored milk
8.7 Low fat milk
8.8 Fat-free milk

Unit 9. Packaging and Distribution of milk 4 hrs.

9.1 Introduction to Packing of milks

9.2 Different packaging material used in dairy industries
9.3 Aseptic packaging system
9.4 Different mode of milk distribution
9.5 Franchise, retail delivery system
9.6 Sales promotion activities and advertisement

Unit 10. Cleaning and sanitation **6 hrs.**

9.7 Introduction to Cleaning and sanitation of dairy equipment
9.8 Manual cleaning method
9.9 Cleaning out of place
9.10 Cleaning in Place in dairy industry
9.11 Sanitation: Hot water, Steam, Chlorine, Peracetic compounds .

PRACTICAL
Total Hours: 45hrs

1. Conduct the reception of Raw milk and its platform tests 5hrs
2. Determine the Fat, SNF and acidity of milk 5hrs
3. Conduct the Study of the working of Cream Separator 6hrs
4. Conduct the Study of the working of butter churner 6hrs
5. Prepare the standardized recombined milk 5hrs
6. Prepare the flavored and sterilized milk 5hrs
7. In pouch Pasteurization of full cream milk 6hrs
8. Conduct the One-day Visit to milk processing factory to observe milk processing, milk filling/ Packing of milk by FFS Machines. 7hrs

Recommended Texts:

- Walstra, P., Geurts, T.J., Noomen, A., Jellema, A., Boekel, M.A.J.S (2005) Dairy Technology: Marcel Dekker Inc.
- Bylund, C. (2003). Dairy Processing Handbook, 2nd Edition. Tetrapak Processing Systems AB, Sweden
- Rajendra P Adhikaryand Chooda Mani Bhandari, (2005). Production Technology of Dairy Products (Nepali version). JanajyotiPustakPasal, Kathmandu, Nepal.
- Rajendra P Adhikary (2070 BS). Milk Factory Cleaning: Principle and Practice. Gyanjyoti Publisher, Kathmandu Nepal.
- De, S. (2005). Outlines of Dairy Technology: Oxford University Press, India.
- Varnam, A.H. and Sutherland, J.P. (1994). Milk and Milk Products: Technology, Chemistry and Microbiology. Chapman & Hall, London.
- Neelu Gupta (2013). A guide to Milk hygiene and public health. IBDC publisher, India

Final written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	8	9	10	Total
Unit Hours	5	4	3	7	6	4	15	6	4	6	60
Marks	7	5	4	10	8	5	20	8	5	8	80

Second Year/Semester II

Food and Nutrition

AG2201FD

Year: II **Total: 4 hours /week**
Semester: II **Lecture: 3 hour/week**
Practical: 1 hours/week
Lab: 0 hours/week

Course Description

This course is designed to give students the fundamental concept of human nutrition, nutrients and foods essential for human body. Emphasis is given to the principles related to foods and macro and micro nutrients required in every day for human life and to the application of human nutrition in Food Technology. An additional function of the course is to stimulate interest in the application of human nutrition and to prepare the student for further study in this field. A practical on different approaches on nutrition acquaints the student with use of related knowledge and skills to provide practical application of learned theory, which is relevant to food technology.

Course Objectives

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

- Explain the basic concepts of food and nutrition.
- Explore of the major nutrients in food
- Apply the knowledge of human nutrition to analyze malnutrition and to improve nutritional status of people.
- Utilize assessment principles in nutritional status testing.
- Explain the use of food, balance diet properly during entire life cycle of human beings.
- Apply the theoretical & practical knowledge of food and nutrition, which is basic requirement of human life.
- Explain about non-communicable diseases related to nutrients and diet

Course contents

Theory **45 hrs**

Unit 1: Fundamentals of Food and nutrition **8 hrs.**

1.1 Introduction of nutrition,
1.2 Basic concept and principles of nutrition,
1.3 The role of nutrition in human development, the importance of nutrition, human body composition and role of nutrition, description of food and nutrition, scope and fields of human nutrition, basic tools in the study of nutrition.
1.4 Dietary sources of nutrients and nutrient interrelationship.
1.5 Nutritive value of foods, macro and micro nutrients and their functions, Carbohydrates, proteins, lipids, minerals, vitamins, dietary fiber and water.
1.6 Essential amino acids, essential fatty acids. Significance of vitamins and minerals and other nutrients.
1.7 Energy value calculations of nutrients, total energy requirement (TER). Basal Metabolic Index (BMI) and its significance.
1.8 Concept of Anti-nutritional factors
1.9 Introduction on three pillars of malnutrition, disease of excessive intake of nutrients, macro and micro nutrients imbalance.

Unit 2: Bio-Chemical aspects of Nutrition **7hrs.**

2.1 Fundamentals of digestion, absorption and metabolism
2.2 Enzyme, factors affecting Enzyme activity
2.3 Digestion, absorption and metabolism of carbohydrate, protein and lipids.
2.4 Concept of glycolysis (definition and general steps)

Unit 3: Malnutrition and Assessment of nutritional status **8 hrs.**

.1 Definition and types of malnutrition, their consequence to human life.
.2 Double and triple burden of malnutrition.
.3 Risk population groups on malnutrition.
.4 Vicious cycle of malnutrition
.5 Description and causes of malnutrition and methods to overcome the problem of malnutrition.
.6 Significance of various nutrients on malnutrition.
.7 Description of balance diet.
.8 Concept of Recommended Daily Allowances (RDA)
.9 Concept of meal planning for different age group, Food balance sheet and food composition table.
.10 Nutritional status of Nepalese people
.11 Concept of nutritional assessment: (definition, purpose, method)
.12 Growth chart of children and its importance

Unit 4: Nutrition in the life stages and food habit **4 hrs.**

4.1 Life cycle approach of nutrition
4.2 Description of food habit in relation to nutrition.
4.3 Socio economic structures, cultures, practices and food taboos and believes affecting nutrition.
4.4 Fundamentals of food sensitivity: food hypersensitivity, food allergy and intolerance.

Unit 5: Food and Nutrition Security **4 hrs.**

5.1 Concept of food and nutrition security,
5.2 Four pillars of food security
5.3 Food utilization in human body and factors influencing food utilization.
5.4 Concepts of effects of unsafe and low quality and contaminated foods in the nutrients and human body.
5.6 Effects on human body due to imbalance nutrients and emerging of non-communicable disease due to salt, sugar, trans-fat.

Unit 6: Role of National and international agencies in Nutrition **6 hrs.**

6.1 The role of different national and international organization (UNICEF) in relation to human nutrition
6.2 Current policy and programs in Human Nutrition of Nepal
6.3 Importance of Information, education and communication programmers on nutrition.

Unit 7: Food supplementation and fortification **6hrs.**

7.1 Fundamental principles of food supplementation,
7.2 Concept of food fortification and food enrichment.
7.3 Importance of food supplementation, food fortification and food enrichment
7.4 Food fortification and food supplementation programs in Nepal.
7.5 Breast feeding and its significance.

7.6 Infant food and weaning food.

Unit 8: Nutritional labeling and claim **2 hrs.**

8.1 Principles of nutritional labeling and claim and its significance.

PRACTICAL
Total Hours:15 hrs.

1. Conduct the study on food composition table. 1hrs
2. Conduct the study on RDA to different age group 1hrs
3. Calculate the energy value of given samples on the basis of carbohydrate, protein and fat Content 1hrs
4. Determine Basal metabolic Index (BMI) of classmates, friends and teachers 1hrs
5. The direct anthropometry measurement method to assess nutritional assessment. 1hrs
6. The indirect dietary study method to assess nutritional assessment i.e. Individual exercise on basic tools in the study of nutrition (determine own desirable body weight, DBW; estimate total energy requirement, TER based on DBW, compute for energy and protein intake based on one 24 food recall, determine one day energy and protein adequacy level) 2hrs
7. Demonstrate and present other direct and indirect nutritional assessment methods. 1hrs
8. Conduct Molish test, test of glucose, fructose and starch test, Ninhydrins test 4Hrs
9. Collect of different recipe of weaning food preparation and preparation of weaning food in the lab. 1hrs
10. Observe nutritional label and claim of different food materials available in market 2hrs
11. Prepare and present of list of allergic foods and other food ingredients which can cause hypersensitivity. 2hrs
    Collect, Prepare and present the list of malnutrition symptoms of human body**.** 2hrs

Recommended Texts:

- Swaminathan M; Advanced Textbook on Food and Nutrition, Vol I and II, the Banglore printing and publishing Co. Ltd., India
- Food and Nutrition Ghosh & Co. Current edition.
- Gutrie HA, Picciano MF; Human Nutrition. New York
- Z.S.C. Okoye; Biochemical aspects of Nutrition, PHI pt. ltd., India
- Bowman BA, Russel RM; Present knowledge in nutrition 8th edition ILSI 2001
- Shils ME, et. al.; Modern nutrition in health and diseases, 9th edition, Philadelphia

Final written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	8	**Total**
Unit Hours	8	7	8	4	4	6	6	2	**45**
Marks	14	12	14	7	7	11	11	4	**80**

Indigenous Food and Dairy Products

AG2202FD

Year: II **Total: 6 hours /week**
Semester: II **Lecture: 4 hour/week**
Practical: 2 hours/week
Lab: 0 hours/week

Course Description

Indigenous food and dairy products have an important role in our society. The course covers the manufacture of different indigenous dairy products from food and milk. Some of the indigenous dairy products are produced and consumed on a special day within a household, but their role is not limited.

Course Objective

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

- Explore the importance of indigenous food and dairy products.
- Analyze different aspects of indigenous dairy products.
- Disseminate recent information on basic and applied aspects of chemistry and technology to use it at the industrial level.
- Prepare indigenous products by processing, packaging, and marketing.

Course Contents:

Theory

Unit 1. Introduction to Traditional dairy products **6 hrs.**

1.1 Introduction to traditional food and dairy products
1.2 Importance of Nepalese traditional dairy products
1.3 Role of traditional dairy products in human nutrition

Unit 2. Desiccated dairy products **8hrs.**

2.1 Introduction to desiccated dairy products
2.2 Production method of Khoa and its health benefits
2.3 Khoa based dairy products: Peda, Barfi, Pustakari, Gudpak

Unit 3. Heat-acid coagulated dairy products **12hrs.**

3.1 Introduction to Heat-acid coagulated dairy products
3.2 Production method of Chhena, Paneer and their health benefits
3.3 Production method of Chhurpi and Dog-chew
3.4 Chhena based dairy products: Rasbary, Lalmon

Unit 4. Fermented dairy products **12hrs.**

4.1 Introduction of Dahi (Curd) and its health benefits
4.2 Role of natural lactic acid culture of dahi making
4.3 Production method of Jujudhau

4.4 Production method of Mahi in wooden pot and its nutritional importance

Unit 5. Fat rich dairy products **8hrs.**

5.1 Introduction to unprocessed butter (Nauni ghee) and its health benefits
5.2 Ghee: Definition and importance of ghee, Traditional method of ghee making, Utilization of ghee and ghee residue in household

Unit 6. Packing and sales of tradition dairy products **8hrs.**

6.1 Introduction and importance of packaging
6.2 Method of packaging, storage and transportation of different dairy products
6.3 Sales and sales promotion of traditional dairy products

Unit 7. Non-marketed tradition dairy products **6 hrs.**

7.1 List of Non-marketed dairy products of Nepal
7.2 Production method of selected dairy products: Dahi pakauda, Khir (rice pudding), Mahi kadhi (sollar) and Chukauni

PRACTICAL
Total Hours 30hrs

1. Prepare Khoa 4hrs
2. Prepare Ghee from butter and cream. 5hrs
3. Prepare Paneer. 5hrs
4. Prepare Chhana and Rasbari 8hrs
5. Prepare Dahi/Jujudhau 3hrs
6. Prepare Mahi kadhi or Khir 5hrs

Recommended Texts:

- Rajendra Prasad Adhikary (2074 BS). Production Technology of Dairy Products, 2nd Edition. Gyanjyoti Books Publication, Nepal.
- Edgar Speer (2018). Milk and Dairy Product Technology, Taylor and Francis
- Sukumar De (2005). Outlines of Dairy Technology: Oxford University Press, India.

Final written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	**Total**
Unit Hours	6	8	12	12	8	8	6	**60**
Marks	7.5	11	16	16	11	11	7.5	**80**

Food and Dairy Chemistry

AG2203FD

Year: II **Total: 8 hours /week**
Semester: II **Lecture: 4 hour/week**
Practical: 4 hours/week
Lab: 0 hours/week

Course Description

Several dairy products are manufactured from food and milk. The quality and varieties of finished products rely on a qualitative and quantitative study of the composition of food and milk. The student's knowledge of the fundamental constituents of food and milk will be very useful for preparation, processing, and storage. Therefore, the course covers basic knowledge about the chemistry of food and milk and their role in the finished product.

Course Objective

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

- Explore the concept of the food and dairy chemistry, their functions, and determination
- Familiar with Physical Properties of milk, fermentation of lactose, deterioration of fat.
- Understand Physico-chemical changes of selected dairy products.
- Analyze Pigments, food additives, and their applications in foods
- Differentiate Enzymatic and Non-enzymatic browning reactions in food.
- Detect Adulteration and preservatives in milk
- Practice Mechanism of browning and their prevention.

Course Contents:
Theory

Unit 1. Introduction to milk and Food chemistry **4hrs.**

1.1 Importance of Food and Dairy Chemistry
1.2 Composition of Foods and their importance
1.3 Average gross composition of Colostrum and milk of Cow, Buffalo, Yak (Chauri), Goat and Sheep
1.4 Difference in composition of Cow and Buffalo milk

Unit 2. Physical Properties of Milk **6 hrs.**

2.1 Physical properties of milk: Colour, Specific Gravity, Refractive Index, Surface Tension, Viscosity, Specific Heat, Boiling Point, Freezing Point, Acidity and pH, Electrical Conductivity

Unit 3. Water **4 hrs.**

3.1 Introduction and Importance of moisture in foods
3.2 Structure of water molecule, types and properties of water
3.3 Water activity and its Importance
3.4 Methods of moisture determination, e.g., Drying methods, Distillation methods, Chemical methods and Physical methods (Lactometer).

Unit 4. Carbohydrates **6 hrs.**

4.1 Definition and Classification of Carbohydrates
4.2 Sources, nutritional and industrial importance of Glucose, Fructose, Sucrose, Maltodextrin and Lactose
4.3 Difference between Reducing and non-reducing sugars
4.4 Definition of Crude fibre and Dietary fibre
4.5 Chemistry of fermentation of lactose into lactic acid
4.6 Lactose intolerance

Unit 5. Proteins **8hrs.**

5.1 Definition and Importance of Proteins
5.2 Introduction to Amino Acids
5.3 nutritional classification of Amino Acids
5.4 Classification of Milk Proteins and their importance
5.5 Casein and Whey Proteins
5.6 Denaturation of Proteins
5.7 Methods of Protein determination (Kjeldahl and Formol Titration)

Unit 6. Lipids **6 hrs.**

6.1 Definition and Importance of Lipids
6.2 Types of Fat, Fatty Acids
6.3 Important physical and chemical properties of fats and oils
6.4 Physico-Chemical constant of milk Fat
6.5 Hydrolysis, Oxidative Rancidity, Saponification and hydrogenation of fat

Unit 7. Enzymes and Food Pigments **6hrs.**

7.1 Definition, mode of action and function of enzymes
7.2 Different types of enzymes used in food processing
7.3 Role of Lipase and Alkaline Phosphatase in milk
7.4 Importance and classification of pigments (Chlorophyll, Anthocyanin, Carotenoids, lycopene), effect of processing and storage
7.5 Definition of Enzymic and non-enzymic browning

Unit 8. Vitamins and Minerals **8 hrs.**

1.1 Definition, importance and types of vitamins
1.2 Fat soluble and water-soluble vitamins
1.3 Loss of vitamins during milk processing (pasteurization)
1.4 Biochemical function of minerals; Importance of Calcium, Phosphorus, Iodine, Iron, Zinc, Floride and their sources
1.5 Major and trace minerals in milk

Unit 9. Enzyme action and ripening **4 hrs.**

9.1 Milk clotting enzymes from different sources- Animal, microbial and plant
9.2 Factors affecting coagulation of milk and characteristics of curd
9.3 Rennet action: Changes taking place during manufacture and ripening of cheese

Unit 10. Food additives **4 hrs.**

10.1 Varieties of fermented dairy products
10.2 Change in milk constituents during fermentation
10.3 Flavour development, Nutritional and therapeutic value of fermented milk products

Unit 11 : Food browning **4 H**

a. Definition, desirable and undesirable aspect of browning, types of browning
b. Non-enzymic browning(in brief): Maillard reaction, Caramelization
c. Enzymic browning(in brief): Occurrence, mechanism and prevention

PRACTICAL
Total Hours: 60hrs

1. Determine proximate composition of food items. 6hrs
2. Determine reducing/non-reducing sugars. 6hrs
3. Determine FFA, peroxide value, refractive index of oil. 7hrs
4. Determine Reichert-Meissl (RM), Polenske Value, and Kirschner Value of ghee. 7hrs
5. Determine iron and calcium in milk 7hrs
6. Determine Vitamin C 7hrs
7. Prepare Butter and Table butter from ripened cream. 7hrs
8. Prepare mozzarella cheese from buffalo milk. 7hrs
9. Detect adulteration in milk. 6hrs

Recommended Texts:

- Principles of Dairy Chemistry. Robert Jennessand RStuart Patton. Medtech India.
- Fundamentals of Dairy Chemistry. Wong, NP, Jenness, R, Keeney, M and Marth EH. CBS Publishers and distributors India.
- Essential of food chemistry, JBKC and BK Rai
- Textbook of Dairy Chemistry. Puspa P. Acharya, Highland Publication P. Ltd. Nepal
- Basic Food chemistry, Mayer
- Fundamental biochemistry, J L Jain

Final written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	**Total**
Unit Hours	4	6	4	6	8	6	6	8	4	4	4	**60**
Marks	5	8	5	8	11.5	8	8	11.5	5	5	5	**80**

Cereal, bakery and confectionery technology

AG2204FD

Year: II **Total: 8 hours /week**
Semester: II **Lecture: 4 hour/week**
Practical: 4 hours/week
Lab: 0 hours/week

Course description:

This course deals with post-harvest handling and basic knowledge of cereal processing and utilization of major cereal grain and their products as well as about baking and confectionery technology. It also deals with the major cereal grain which effect the milling yield. Primarily, it imparts the basic knowledge about the grain milling and also provides the knowledge of preparation of different quality cereal products. Students will be able to know about sugar confectionery products and bakery products.

Course objectives:

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

- Handle major cereal grain during postharvest
- Conceptualize physical properties of grain which effect the milling yield
- Familiar with milling technology of wheat and rice
- Prepare wheat flour products
- Discuss the nutritional aspects of wheat, rice and their improvement
- Prepare confectionery products and bakery products

Course Contents:

Theory

Unit 1. Harvesting and handling of major cereal grains **15hrs.**

1.1 Introduction and distribution of important cereal grains: Rice, wheat and maize.
1.2 Post-harvest handling of wheat, paddy, and maize.
1.3 Physical properties of cereal grains.
   a. Bulk density, density specific gravity.
   b. 1000 kernels weight.
   c. Length (l), breadth (b), thickness (t), l/b ratio
1.4 Structure and chemical composition of rice, wheat and maize

Unit 2: Milling of Cereal Grain **15hrs.**

2.1 Wheat milling – cleaning, hydro thermal treatment, burr milling, hammer milling and roller milling system, *atta*, *maida* and their quality
2.2 Rice milling: cleaning, englobing milling, huller milling and Sheller milling system, paddy separation, whitening, grading
2.3 Parboiling of rice and its benefits
2.4 Utilization of by products: husk and bran

Unit 3: Technology of cereal products **15hrs.**

3.1 Production of bread, biscuits, raw materials, processing methods quality and packaging.
3.2 Noodles: Raw materials, processing methods, quality criteria, instant noodles, quality of products and packaging.
3.3 Production of breakfast cereal corn flakes, beaten rice, puffed rice.

Unit 4: Technology of baking **5hrs.**

4.1 Introduction to technology of baking
4.2 Types and properties of baking ingredients, leavening agent
4.3 Technology of bread, cookies, biscuits, cake, doughnut

Unit 5: Technology of sugar confectionery **10 hrs.**

5.1 Types of sugar confectionery products (Introduction and types-hard boiled, soft boiled)
5.2 Manufacturing technology of sugar confectioneries (Raw material processing details, equipment required)
5.3 Machinery required for sugar confectionery manufacturing:

- Types of equipment: Heaters and hotplates,

5.4 Factors affecting the production and storage of sweets.
5.5 Major candy types: crystalline and non-crystalline (Rock candy, Fondant, toffees and caramels)
5.6 Microbiological and other spoilage problems of confectionery and chocolate products

PRACTICAL

Total Hours: 60hrs

1. Determine the dimensional properties of rice, wheat, and maize	2 H
2. Determine the gravimetric properties of rice, wheat, and maize	2 H
3. Study structure of rice, wheat, and maize	2 H
4. Study the chemical composition of rice, wheat, and maize	2 H
5. Carry out the milling of rice and wheat	3 H
6. Perform Grading of rice grain and wheat flour	3 H
7. Determine the gluten of wheat flour	3 H
8. Prepare noodles and evaluate the quality	6 H
9. Prepare the bread and evaluate its quality	6 H
10. Prepare cake and evaluate its quality	6 H
11. Prepare cookies and evaluate their quality	6 H
12. Prepare caramel and toffee and their quality evaluation	6 H
13. Carry out industrial visit	8 H
14. Submit the report of the industrial visit	5 H

Recommended Texts:

- Kent N. L. and Evers A. D (2004). *Kent's Technology of cereal of Cereals*. Woodhead Publishing: England.
- Sahay K. M. and Singh K. K. (2001). *Limit Operations of Agricultural Processing*. Vikas Publishing House, India.
- Chakraverty . A. (2000). *Post-harvest Technology of Cereals, Pulses and Oilseed*. Oxford & IBH Publishing: Calcutta, India.
- Bandyopadhyaya, S. and Roy, N. C. (1992). *Rice Process Technology*. Oxford & IBH Publishing, India.
- Lees R & Jackson EB; Sugar Confectionery and Chocolate manufacture, Leonard Hill 1973
- Beeket ST (ed); Industrial Chocolate Manufacture and its use, Blackie and Son Ltd., London, 1998
- Matz A, Cereal and Bakery technology CBS Publishers, 1990

Food and Dairy Engineering

AG2205FD

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

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

Practical: 2 hours/week

Lab: 0 hours/week

Course Description:

The course in Food Engineering is designed to provide the student with knowledge of the fundamental principles of engineering applied in the subject area of food science and industries related to food processing. The course covers various areas of food engineering such as various unit operations.

Course objective:

On completion of the course the students will be enabled to

- Understand the unit operations: mass balance and heat balance
- Familiar with Fluid flow and Fluid pressure
- Conceptualize the heat transfer system in different conditions
- Understand the drying and evaporation process
- Perform process of distillation and crystallization
- Conceptualize size reduction and mixing

Course content

Theory

Unit 1: Mass and energy balance **4 hrs.**

1.1 Law of conservation of mass, overall mass balance and component balance

1.2 Law of conservation of energy, sensible heat, enthalpy, latent heat

1.3 Simple exercises on mass and energy balance (Special reference with dairy science)

Unit 2: Fluid Flow **6hrs.**

2.1 Fluid flow, Continuity equation, Concept of viscosity, Newtonian and non-Newtonian fluid (Special Reference to dairy)

2.2 Concept of pressure and fluid pressure

2.3 Reynold's number and type of flow: laminar and turbulent

2.4 Poiseuille's equation, Bernoulli's law

2.5 Flow meters (venturi meter, orifice meter, rotameter, pitot tube)

Unit 3: Heat transfer **8hrs.**

3.1 Conduction: Specific heat capacity, Thermal conductivity, Various modes of heat transfer, Fourier's law of heat transfer, heat transfer through a slab and a cylinder, heat transfer through multilayer slab and cylinder

3.2 Convection: Convective heat transfer coefficient, overall heat transfer coefficient, counter current and co-current heat transfer, LMTD, related exercises, (Special reference to dairy)

3.3 Heat Exchanger: Tubular heat exchanger, Surface Scrapped heat exchanger, Shell and tube heat exchanger, plate heat exchanger, their application in different food industry

Unit 4: Drying **8hrs.**

4.1 Concept of drying, dry and wet basis moisture, relative humidity, water activity and equilibrium moisture content, Drying mechanism

4.2 Drying curve: constant rate and falling rate period, critical moisture content, drying time calculation

Unit 5: Evaporation **6hrs.**

5.1 Introduction, Boiling point elevation, amount of steam needed to achieve evaporation,

Climbing and falling film evaporators, Single effect and multiple effect evaporators, Principle of heat transfer in the production of fruit concentrates, condensed milk

Unit 6: Distillation **4hrs.**

6.1 Introduction to distillation, Raul's law, Boiling point diagram of binary mixture, Batch distillation, Rectification: rectification column, working principle of rectification process

Unit 7: Crystallization **4hrs.**

7.1 Unsaturated, saturated and Supersaturated solutions, solubility curve, Basic principle of crystallization: nucleation and crystal growth, factors affecting crystal growth, Industrial applications of crystallization

Unit 8: Separation technique **10hrs.**

8.1 Sedimentation: Terminal velocity, drag coefficient free and hindered settling

8.2 Centrifugation: Centrifugal separation, working principle of centrifugal separator with an example of cream separator

8.3 Filtration: Theory of constant rate and constant pressure filtration, plate and frame filter press, rotary vacuum filter

Unit 9: Size Reduction **6hrs.**

9.1 Size reduction: definition, application

9.2 Size reduction law (Rittinger's law, Kick's Law, Bond's law)

9.3 Size reduction equipment: Jaw crusher, Gyratory crusher, roll crusher, hammer mill)

9.4 Fineness modules, uniformity index

Unit 10: Mixing **4 Hrs.**

10.1 Mixing: Solid-Solid mixing, Solid-Liquid Mixing, Liquid-Liquid Mixing, Homogenization in Dairy Industry

PRACTICAL

Total Hours: 30hrs

1. Excise simple mass and energy balance 6hrs
2. Observe flow pattern (laminar or turbulent) and calculation of Reynold's number 3hrs
3. Measure the viscosity, concentration effects of viscosity 3hrs
4. Exercise to find the number of the theoretical plate in a rectification column 3hrs
5. Perform fruit or vegetable drying and make a drying curve 6hrs
6. Perform Boiling point elevation 6hrs
7. Conduct the industrial visit of the Dairy Industry (Observe different unit operations involved 3hrs

Recommended Texts:

1. Christie J. Geankoplis, Transport Process and Unit operations, Prentice-Hall International, Inc.
2. R Paul Singh, Dennis R. Heldman, Introduction to Food Engineering, Food Science and Technology International Series
3. Toledo, Romeo T, Fundamentals of Food Process Engineering, Third edition, Springer publication

Final written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	8	9	10	**Total**
Unit Hours	4	6	8	8	6	4	4	10	6	4	**60**
Marks	5	8	11	11	8	5	5	14	8	5	**80**

Fruits and Vegetables Technology

AG2206FD

Year: II **Total: 6 hours /week**
Semester: II **Lecture: 4 hour/week**
Practical: 4 hours/week
Lab: 0 hours/week

Course description:

This course covers maturity, ripening process, harvesting method, sorting and grading, packaging, transportation, storage, nutritional value and types of processed products of fresh fruits and vegetables. This will provide basic principle, definition, process of manufacturing, storage, quality aspect, spoilage factors on processed products of fruits and vegetables. This course also provides basic knowledge on management and utilization of fruits and vegetables during glut season. Both the theory and practical knowledge of technology help the students to develop more confidence.

Course objectives:

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

- Perform fruits and vegetables preservation.
- Operate manufacturing process of different processed products like Squashes, RTS, fruit juices, jams, jellies, marmalades, Candied, preserves, ketchups, sauces, pickles, chutney.
- Conduct packaging, storage, quality product and causes of spoilage of the product
- Work in fruits and vegetables industries and also able to conduct their own small-scale industry.

Course Contents:
Theory

Unit 1: Introduction to Fruits and Vegetables **6 hrs.**

1.1. Production and productivity of major fruits and vegetables of Nepal
1.2. Types of fruits and vegetables grown in temperate, sub-tropical and tropical zone.
1.3. Nutritional importance and nutrient content in fruits and vegetable (F/V)
1.4. Types of processed product of F/V
1.5. Spoilage of fruits and vegetables.
1.6. Postharvest losses: Causes, and Mitigation

Unit: 2: Post harvest operation of fruits and vegetables **10hrs.**

2.1. Importance of maturity, stage of maturity of different F/V, maturity standard, ripening process of fruits, climacteric and non-climacteric fruits, harvesting methods, collection Centre,
2.2. Importance and methods of sorting and grading, packaging, transportation and storage of F/V
2.3. Principle of storage, Type of storage: cold storage, cellar storage, controlled atmosphere storage, and modified atmosphere storage

Unit: 3: Drying and Dehydration of fruits and vegetables **8 hrs**

3.1 Principle of drying and dehydration

- Importance of blanching for drying,
- Methods of Drying fruits and vegetables
- Types of dryers used for drying of F/V, Sun drying, solar drying, cabinet dryer

3.2 Dehydration ratio and Rehydration ratio
3.3 Storage of dried F/V
3.4 Causes of spoilage of dried products

Unit: 4: Fruits and vegetables canning **8 hrs.**

4.1 Principle of canning and bottling of F/V
4.2 Types of cans used for fruits and vegetables
4.3 Types and desirable properties of fillers used in canning
4.4 Detail process of canning of fruits and vegetables
4.5 Causes and types of spoilage of canned food.

Unit: 5: Fruit Beverages {squashes, ready-to-serve (RTS), juices, cordials and concentrate} **8hrs.**

5.1 Equipment of fruit juice extraction like Juice extractor, basket press
5.2 Straining, filtration and clarification:
5.3 Preservation of juices using chemical preservatives and pasteurization methods
5.4 Specification and preparation methods of squashes, cordials, RTS (mango, litchi, apple)
5.5 Fruit juices, concentrate of juice, quality control, type of spoilage.

Unit 6: Pickles, Chutney and tomato products **8 hrs**

6.1 Pickling process
6.2 Preparation methods of pickles (oil pickle, salted pickle), chutneys
6.3 Function of ingredients in pickles, sauces, chutney
6.4 Keeping quality of pickle and chutneys and causes of spoilage.
6.5 Specification and preparation method of tomato ketchup, sauces and keeping quality, causes of spoilage.

Unit 7: Jams, jellies and marmalades **8hrs**

7.1 Definition of pectin, pectin rich fruits, sources and uses of pectin, test of pectin in fruits using alcohol.
7.2 Pulping of fruits, method of bulk storage of fruit pulp using chemical preservatives
7.3 Definition of jam, jelly and marmalade, types of fruits used for their preparation, jam preparation from apple, mixed fruit jam, mango jam.
7.4 Jelly and marmalade preparation from fruits
7.5 Defect of jam, jelly and marmalade, keeping quality and causes of spoilage.

Unit 8: Preserves, candied and Crystallized fruits **2hrs**

8.1 Definition of preserves, candied and crystallized fruits and selection of suitable fruits and vegetables
8.2 Preparation method of preserves, candied and crystallized fruits from fruits and vegetables and proper packaging.

Unit 9: Plant layout and waste management **2hrs**

9.1 Plant layout of fruits and vegetables industries

- Importance, design and required processing equipment for the fruits and vegetables industries
- Waste Management of fruits and vegetables industries

PRACTICAL
Total Hours 60hrs

1. Carry out grading and sorting of fruits and Vegetable 2 H
2. Prepare the layout of the juice processing industry 3 H
3. Prepare and confirm different strengths of syrup and brine 4 H
4. Prepare squashes from seasonal fruits. 2 H
5. Prepare fruit jam, jelly, and marmalade. 10 H
6. Test the pectin content of the fruit using absolute alcohol 2 H
7. Prepare ready-to-serve juice from fruit using standard specification 6 H
8. Perform drying and dehydration of fruits and vegetables using solar and Cabinet Dryers, packing and storage of dried product, and calculate the dehydration and rehydration ratio 7 H
9. Prepare preserves and candy from the fruits and vegetables. 6 H
10. Prepare tomato ketchup, and sauces using standard specifications. 4 H
11. Prepare pickles and chutney from fruits and vegetables. 4 H
12. Visit locally available fruits and vegetables collection centers, Industries, and markets. 10 H

Recommended Texts:

- Preservation of fruits and vegetables---By Girdhari Lal, G. S. Siddappa and G.L. Tandon.Published by ICAR.
- Principle of food Preservation ---By Ganga P Kherel, Fumio Hashinaga.
- Postharvest Technology for small scale produce Marketers, Economic opportunities,
- Quality and Food safety By—Lisa Kitinoja and James R. Gorny, Department of
- Pomology, University of California, Davis.

Final written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	8	9	**Total**
Unit Hours	6	10	8	8	8	8	8	2	2	**60**
Marks	8	13	11	11	11	11	11	2	2	**80**

Third Year/Semester I

Food Analysis, Food Safety and Quality Control

AG3101FD

Year: III **Total: 8 hours /week**
Semester: I **Lecture: 4 hour/week**
Practical: 4 hours/week
Lab: 0 hours/week

Course Description

The course is designed to provide the student with knowledge and in-depth skill of the principles of chemical and instrumental methods for the qualitative and quantitative analysis of major food components. Course also includes food analysis procedures and their importance, food quality, and safety, course explains different terms such as food hazards, risk, quality control & assurance; adulterations, standardization, and basic management tools like GHP, GMP, HACCP, ISO practices in Nepal

Course Objectives

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

- Demonstrate understanding on basic principles, importance, and methods of food analysis.
- Explore skills of modern analytical methods applicable to the analysis of food.
- Perform selected food analysis techniques.
- Understand the basic principles of food analysis and their importance
- Understand the concept of the regulatory framework of Nepal (Food law, Food Regulation, and Feed law) and mandatory food and feed standards
- Test sensory attributes of foods
- Understand food adulteration, identification, and corrective action
- Familiarize the prerequisite of HACCP and GMP and the concepts of ISO
- Conceptualize the fundamentals of a quality management system

Course contents

Theory

Unit 1: Introduction, importance and methods of food analysis **2hrs.**

1.1. Introduction, Importance, different techniques of food analysis
1.2.Lab overview: guidelines, safety and report writing
1.3.Introduction to GLP and concept and Principles of GLP

Unit 2: Proximate and Ultimate analysis of food **3hrs.**

2.1.Concept of proximate analysis and ultimate analysis
2.2.Analysis of proximate constituents of foods i.e., Moisture, Crude protein, Crude fat, Crude fiber, Ash, Acid insoluble ash, Carbohydrate, Acidity, Alcoholic acidity

Unit 3: Analysis of Water **4hrs.**

3.1. Standard of processed drinking water,
3.2 Water Treatment
3.3 Analysis of physiochemical (pH, Total dissolved solids, Hardness, Alkalinity, arsenic, residual chlorine) and microbiological characteristics (total coliform count) of water.

Unit 4: Chromatographic techniques **4hrs.**

4.1 Principles of Chromatography

4.2 Types of Chromatographic techniques
4.3 Paper Chromatography, TLC and HPLC

Unit 5: Spectrophotometric techniques of analysis **1hrs.**
5.1 Principles of Spectrophotometry

Unit 6: Fundamentals of food safety, quality control and assurance **6hrs.**
6.1 Definition of quality
6.2 Difference of quality control and assurance
6.3 Concept of food safety
6.4 Definition of hazards and their types
6.5 Differences between hazard and risk

Unit 7: **Quality Attributes of foods** **5hrs.**
7.1.Introduction to Quality attributes of foods
7.2.Introduction to Sensory evaluation of food, its benefits in food testing
7.3.Sensory attributes of foods: Colour, flavor, texture, tastes.
7.4.Sensory evaluation tools and techniques
7.5.Hedonic Scale

Unit: 8 Food adulteration and detection **5hrs.**
8.1.Introduction to adulteration
8.2.Types of adulterants (intentional and unintentional)
8.3.Health hazards related to adulterants
8.4.Simple techniques for detection of food adulteration

Unit: 9 Food and feed laws and regulations **7hrs.**
9.1 Introduction to food and feed laws and food regulations
9.2 Mandatory food standards focusing regulatory provisions of food additives
9.3 Role of government bodies in food control system
9.4 Competent national authority directly involved in food control system and other interrelated agencies
9.5 Role of government in food control system
9.6 Role of producer, traducers and consumers for food safety and quality

Unit: 10 Food plant sanitation and Hygiene **7hrs.**
10.1Introduction to hygiene and sanitation
10.2 Personal hygiene and plant hygiene
10.3 CIP in plant sanitation
10.4 Cleaning reagents and sanitizers

Unit 11: Preventive tools of Food safety **7hrs.**
11.1 Concepts of GMP, GHP, GAP
11.2 Introduction to HACCP
11.3 Principles of HACCP
11.4 Steps in HACCP
11.5 Concepts of Hygienic design

Unit 12: Introduction of ISO series **3hrs.**
12.1 Introduction and principles of ISO

12.2 12.2 ISO series: 9001, 22000, 14000, 17025

Unit 13: Factory layout and design 2h**rs**
13.1Importance of plant layout and design for safe and quality food production
13.2Basic concepts of hygienic design

Unit 14: Concepts of SPS and TBT **2hrs.**
14.1 General introduction to Sanitary and Phyto sanitary
14.2 General introduction to Technical Barrier to Trade (TBT)

Unit 15: CODEX, INFOSAN and their functions **2hrs.**
16.1 Introduction to CODEX
16.2 Roles of CODEX in standard formulation
16.3 Introduction of INFOSAN and its function

PRACTICAL
Total Hours 45hrs

1. Test the various adulterants in fats and oils, Milk, turmeric, cereals, Sweets, and honey 4 H
2. Carry out the grading of cereals, legumes & oilseeds 1 H
3. Study sampling tools, methods, and conduct sampling of cereals, milk, spices, fats, and oils. 5 H
4. Prepare a hygienic design and good layout of the dairy industry 4 H
5. Conduct a study on mandatory labeling information of food products as per food laws and Regulation 4H
6. Demonstrate and study hazards (physical, chemical, and microbiological) in specific food production systems 4 H
7. Calibrate the measuring devices (pipettes, burettes, and vol. flasks), Prepare standard solutions1 HA analyze proximate constituents of foods i.e. Moisture (hot air oven and dean stark apparatus), Crude Protein (Kjeldahl and Formal Titration method), Crude fat, Crude fiber, Ash, and Carbohydrate (by difference) 8 H
8. Determine alcohol content in alcoholic beverages 2 H
9. Determine total Sugar, acid-insoluble ash, and alcoholic acidity 2 H
10. Carry out Chromatographic separation and identification of dyes 3 H
11. Carryout Physiochemical (pH, Total dissolved solids, Hardness, Alkalinity) analysis of water 2 H
12. Conduct Field visits to Food Processing Industries to study Quality Management Systems like HACCP/ ISO adopted in food industries 5 H

Recommended Texts:

- Jerry Banks, Principle of Quality Control, Wiley Johan, Wiley and Sons, New York
- Food Quality Assurance: Principles and Practices,
- Food Industry and Quality Control, Mark Clue, CRC Press
- Sensory Shelf Life Estimation of Food Products, Guillermo Hough, 2010 by CRC Press , 63 B/W Illustrations, ISBN 9781420092912 – CAT
- Quality Assurance for the Food Industry: A Practical Approach, J. Andres Vasconcelos, 2003 by CRC Press, 59 B/W Illustrations, ISBN 9780849319129 – CAT

- Food Safety Management Programs, Application, best practices and compliances, Bebby Newslow, 2013 by CRC Press,389 Pages - 26 B/W Illustrations, ISBN 9781439826799 – CAT
- Handbook of Analysis of Fruits and Vegetables by S. Rangana
- Basic food analysis handbook by K. C., Jagat Bahadur and Rai, Basanta Kumar
- Handbook of Analysis of Fruits and Vegetables by S. Rangana

Final written Exam Marking Scheme

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

Beverages and Spices Technology

AG3102FD

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

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

Practical: 2 hours/week

Lab: 0 hours/week

Course description:

This course provides basic knowledge on different beverages (especially nonalcoholic beverages including tea, coffee, cocoa beverage and soft drinks) and spices. It provides knowledge on importance, feasibility, Cultivation, variety, marketing & industries of tea, coffee and spices in Nepal. It's including composition, different processing methods & quality parameters of tea, coffee & spices. Processing technology of tea, cherry coffee & parchment coffee size grading, packaging & storage of tea & coffee. Also includes Quality evaluation, including cup testing sensory evaluation, detection of adulterations of tea, coffee & spices. Also provide chemical composition, processing, drying storage extraction of essential oil & oleoresin of different spices of Nepal. This course also provides basic knowledge on management and utilization of tea, coffee and spices with better quality during glut season. Both the theory and practical knowledge of technology help the students to develop more confidence.

Course objectives:

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

- Conceptualize the knowledge on cultivation, variety, production & industries of tea, coffee and spices in Nepal.
- Perform processing of tea, cherry & parchment coffee & different major spices produce in Nepal.
- Conduct drying and dehydration of different major spices.
- Perform storage & packaging of tea, coffee & spices.
- Detect adulteration & quality parameter.
- Familiar with cocoa beverages and soft drinks
- Extract oleoresin & essential oil of major spices of Nepal.

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Theory

Course Contents:

Unit 1: Introduction of Tea and Coffee (production, cultivation, variety) 8 hrs.

1.1 Introduction, production and productivity of Tea and Coffee
1.2 Varieties of tea and coffee
1.3 Cultivation techniques of tea and coffee
1.4 Coffee and tea industries in Nepal

Unit 2: Processing of Tea (Orthodox, CTC and green tea and Instant tea) 12 hrs.

2.1 Importance of Plucking technique and practice
2.2 Methods of transportation
2.3 Withering technique, physical and chemical changes during withering, degree of withering
2.4 Importance of rolling, different types of rollers

2.5 Importance of fermentation, chemical changes during fermentation, aroma and colour strength development, different methods of fermentation,
2.6 Importance of drying, different types of dryers
2.7 Importance and method of sorting, grading and packaging, different types of packaging material and storage

Unit 3: Processing of Coffee **10 hrs.**

3.1 Picking and grading techniques
3.2 Different processing methods (dry and wet), pulping technique, fermentation methods, drying techniques, hulling method, grading method and its importance
3.3 Packaging and storage of coffee beans.

Unit 4: Quality of tea and coffee **12 hrs.**

4.1 Definition of quality
4.2 Composition of tea and coffee
4.3 Factors affecting parameters
4.4 Types of adulteration.
4.5 Detection techniques of adulteration

Unit 5: Cocoa beverage **4 hrs.**

5.1 Definition, production, processing technology, composition

Unit 6: Soft drinks **4 hrs.**

6.1 Carbonated beverages
6.2 Fruit flavors
6.3 Sparkling (soda) water ingredients used in soft drink production

Unit 7: Production, Processing and quality evaluation of spices **10hrs.**

7.1 Definition of spices.
7.2 Commercial production of ginger, turmeric, chilies, cardamom and black pepper

- Cultivation practice of ginger, turmeric, chilies, cardamom and black pepper
- National Production and productivity ginger, turmeric, chilies, cardamom and black pepper
- Chemical composition ginger, turmeric, chilies, cardamom and black pepper
- Processing methods of ginger, turmeric, chilies, cardamom and black pepper
- Drying methods and techniques of packaging
- Economic benefit of packaging & storage.

PRACTICAL
Practical:30hrs

1. Collection and identification of tea samples (CTC, Orthodox, Green) 3 H
2. Collection and identification of Coffee beans (green, parchment, roasted, and cherry coffee) 3 H
3. Determine the hot water extract, caffeine content, and Moisture content of tea. 6 H
4. Perform the tea testing with the standard cup testing method 3 H
5. Determine the moisture content of different spices 2 H
6. Extract essential oil from different spices 2 H
7. Extract oleoresin from different spices 3 H
8. Prepare dried ginger. 4 H

9. Prepare fruit beverages and fruit-flavored drinks 4 H

Recommended Texts:

- Clarke, R.J. & Macrae, R (eds) Coffee vol-1 & 2 Chemistry & Technology. Elsevier Applied Science Publisher London & New York 1985.
- Eden J (1976) Tea 3rd edition Long Man London.
- Harter C.R. Tea Manufacture, Oxford University press, London. 1963.
- Pruthi JS. Spices & condiments ICAR New Delhi 1998.
- Oli P, 2011 Post-Harvest Technology on Tea, Coffee & Spices, publisher Lalitpur Valley College, Lalitpur.
- Banerjee B, 1996, Tea Production& Processing , Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.
- Verma AH and JP Sutherland, Beverage Technology: Chemistry and Microbiology CBS Publishers,, 1986
- H.W. Houghton, Development in Soft drink Technology, Applied Science Publishers, 1984

Final written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	**Total**
Unit Hours	6	12	10	12	4	4	12	**60**
Marks	8	16	14	16	5	5	16	**80**

Technology of Dairy Products

AG3103FD

Year: III **Total: 9 hours /week**
Semester: I **Lecture: 4 hour/week**
Tutorial:1 Hour/Week
Practical: 4 hours/week
Lab: 0 hours/week

Course Description:

The course aims to provide basic knowledge and skills for the quality production of Dairy Products. The major focus of this course shall be on developing competency in theoretical knowledge practically in daily life as well as in dairy industries, proper handling and preservation techniques, and quality analysis of dairy products. This course will make students able to work in Small as well as large-scale dairy industries and also helps to establish dairy-related industries of their own.

Course Objectives:

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

- Understand the concept of dairy products
- Describe the composition of the Dairy products
- Develop Manufacturing process/flow chart of the Dairy products
- Describe the storage and packaging materials used for Dairy products
- Utilize the by-products of dairy products.

Theory

Unit 1. Cream **4 hrs.**

1.1 Introduction, Definition, Composition and Classification of Cream
1.2 Production process of Sterilized cream and Whipping cream
1.3 Packaging, Storage and Uses of cream

Unit 2. Butter **6 hrs.**

2.1 Introduction, Definition, Composition of Butter
2.2 Principle of butter making: Batch and Continuous method
2.3 Churning and Working process of butter making
2.4 Packaging, Storage and Uses of butter

Unit 3. Ghee **6hrs.**

3.1 Introduction, Definition, Composition of Ghee
3.2 Method of manufacturing: Traditional method, Creamery method, Creamery butter method, Industrial (pre-stratification) method
3.3 Over-run in butter
3.4 Packaging, Storage and Uses of ghee
3.5 General description about butteroil and anhydrous milk fat

Unit 4. Ice cream **6hrs.**

4.1 Introduction, Definition, Composition of Ice cream
4.2 Ice cream ingredients, stabilizers and emulsifiers, flavoring and colouring materials
4.3 Calculation of mixes

4.4 Mix processing, packaging and handling of Ice cream
4.5 General introduction about Softy Ice cream, Kulfi, Chocobar
4.6 Packaging, Storage and Uses

Unit 5. Condensed/ Evaporated milk **6 hrs.**
5.1 Introduction, Definition, Composition of Condensed milk
5.2 Manufacturing process of Condensed and Evaporated milk
5.3 Defects in Condensed/Evaporated milk: Age thickening and gelation
5.4 Packaging, Storage and Uses

Unit 6. Milk Powder **8 hrs.**
6.1 Introduction, Definition, Composition of Milk powder
6.2 Types of milk powders and method of manufacture of Skimmed milk powder (SMP), Whole milk powder (WMP), Dairy whitener (DW)
6.3 Packaging, Storage and Uses

Unit 7. Cheese **10 hrs.**
7.1 Introduction, Definition, Composition of Cheese
7.2 History and theory of cheese making
7.3 Classification and composition of common varieties of Cheese
7.4 Technology of manufactures of Yak, Kanchan, Mozarella, Processed cheese, Cheese spread
7.5 Ripening of Cheese
7.6 Packaging, marketing and Uses

Unit 8. Yoghurt **8 hrs.**
8.1 Introduction, Definition, Composition of Yoghurt
8.2 Yoghurt Culture and production process of Yoghurt
8.3 Therapeutic properties of fermented products
8.4 General introduction: Prebiotic and Probiotic
8.5 Lactose intolerance
8.6 Packaging, marketing and Uses

Unit 9. By-product Utilization **6 hrs.**
9.1 Introduction, classification and characterization of by-products
9.2 Use of butter milk, Ghee residue, Cheese whey and Paneer whey

PRACTICAL
Practical 60hrs
1. Analyze cream: Acidity, Fat, Moisture content 5hrs
2. Conduct standardization, neutralization, pasteurization and cooling of cream 8hrs
3. Analyze the butter: Acidity, Fat, Moisture content 5hrs
4. Select ingredients for Ice cream, calculation of mix preparation 4hrs
5. Conduct the production of Ice Cream and kulfi 8hrs
6. Analyze the Ice cream: Acidity, Fat, Over-run, Total Solids 5hrs
7. Prepare of ghee from cream and butter 4hrs
8. Conduct one day dairy plant visit to observe production process of milk products 8hrs
9. Conduct the production of Dahi/Yoghurt and its quality analysis 3hrs
10. Conduct the production of Mozarella cheese 5hrs
11. Analyse the Kanchan cheese: Moisture, fat, Fat in dry matter 5hrs

Recommended Texts:

- Acharya Pushpa Prasad, Text Book of Dairy Technology, Highland Publication (P.) Ltd.
- Rajendra Prasad Adhikary (2074 BS). Production Technology of Dairy Products, 2nd Edition. Gyanjyoti Books Publication, Nepal.
- Sukumar De (2005). Outlines of Dairy Technology, Oxford University Press.
- Deepak Tiwari and Madhav Pandey ((2074 BS). *AAdharvutdugdhabigyan.* NPI, Bharatpur, Nepal
- Heinrich von Bamberger, Milk and Dairy Product Technology
- Varnam A., Sutherland Jane P. Milk and Milk product

Final written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	8	9	**Total**
Unit Hours	4	6	6	6	6	8	10	8	6	**60**
Marks	5	8	8	8	8	11	13	11	8	**80**

Meat and Fish Technology

AG3104FD

Year: III **Total: 8 hours /week**
Semester: I **Lecture: 4 hour/week**
Practical: 4 hours/week
Lab: 0 hours/week

Course Description

The course aims to provide basic knowledge and skills for the quality production of meat and meat products. The major focus of this course shall be on developing competency in good slaughtering practices, production of quality meat and meat products, proper handling and preservation techniques, and quality analysis of meat, fish, and poultry products.

Course Objectives

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

- Understand composition and nutritive value of meat tissues.
- Handle pre-slaughter, slaughtering, and dressing of meat animals.
- Explain postmortem changes in meat (muscle).
- Accomplice meat cutting and packaging.
- Manufacture meat products.
- Grade and preserve eggs.
- Preserve fish some common methods of fish preservation.

Course Content

Theory

Unit 1: Composition and nutritive values of meat **3 hrs.**

1.1 Definition of meat, skeletal muscle, connective tissue, smooth muscle, cardiac muscle.
1.2 Composition of muscle tissue: water, protein, lipid, carbohydrate, minerals, and vitamins
1.3 Nutritive values of meat (protein, fat, minerals, and vitamins)

Unit 2: Pre-slaughter handling, Slaughtering, and dressing of meat animals (poultry, pig, goat) and slaughterhouse management **18 hrs.**

2.1. Pre-slaughter handling, slaughtering, and dressing of meat animals

2.1.1 Transportation techniques of meat animals, guidelines for preventing stress conditions in meat animals
2.1.2 Ante-mortem inspection, different ritual methods of slaughtering
2.1.3 Definition of stunning and different methods of stunning
2.1.4 Bleeding techniques, dressing techniques, evisceration techniques, postmortem inspections, carcass chilling techniques

2.2 **Poultry slaughtering** **4hrs.**

2.2.1 Pre-slaughter handling and antemortem inspection
2.2.2 Stunning, bleeding techniques, scalding, de-feathering, cropping and venting techniques, evisceration techniques, postmortem inspections, and carcass chilling techniques.
2.2.3 Cut up parts

2.3 **Slaughterhouse management** **4 hrs.**
2.3.1 Definition of the slaughterhouse, types
2.3.2 Design of slaughterhouse
2.3.3 Good practices in a slaughterhouse

Unit 3: Postmortem changes in meat (muscle) **4 hrs.**
3.1 Rigor mortis
3.2 PSE meat, DFD meat, Cold shortening, Thaw-rigor

Unit 4 Meat cutting **4 hrs.**
4.1 Introduction to meat cutting, basic requirements of proper meat cutting, primal cuts of pork and lamb/goat

Unit 5: Meat quality **4 hrs.**
5.1 Sensory quality, technological quality, and safety aspects of meat
5.2 Factors affecting the quality of meat

Unit 6: Meat preservation **8 hrs.**
6.1 Use of different preservation techniques; low temperature, salting & curing, smoking, thermal processing, drying & dehydration, and irradiation

Unit 7: Meat Product Technology **3hrs.**
7.1 Definition of the products, raw materials, and manufacturing process
- Sausage technology
- Smoking technology
- Canning meat
- Cured meat
- Dried meat
- Meat pickle
- Traditional meat products

Unit 8: Egg technology **3hrs.**
8.1 Process of egg formation
8.2 Composition and nutritive value
8.3 Egg grading
8.4 Egg spoilage and defects
8.5 Methods of egg preservation

Unit 9: Fish preservation **3hrs.**
9.1 Preservation of fish (Low temperature, Salting, and drying)
9.2 Fish Products (Smoking, fish marinades, fish sauce, fish paste, surimi, fish crackers)
9.3 Subjective Evaluation of fish

Unit 10: Meat and fish by-products utilization **2hrs.**
10.1 Introduction, classification, the importance of utilization, nutritional aspects of meat by-products
10.2 Uses of meat by-products: lard, tallow, gelatin, leather, blood, viscera Fish leather, Chitin, chitosan, fish glue, fish gelatin

PRACTICAL

Total Practical 60hrs.

1. Carry out slaughtering/ dressing and preparation of ready-to-cook chicken and cut-up parts 7hrs
2. Determine water holding capacity of meat, cooking loss and drip loss 6hrs
3. Prepare sausage, cured meat, ham, Bacon, patty, sukuti, *b*attered and breaded meat products 18hrs
4. Conduct the grading of an egg by candling, USDA system, and Haugh unit method 7hrs
5. Conduct the grading of fish by subjective evaluation method 5hrs
6. Conduct the preservation of fish by dry curing, wet curing, smoking and drying 7hrs
7. Prepare fish meal powder, fish pickle, fish marinade, fish cutlet, fish finger, fish flakes, fish soup powder 10hrs

Recommended Texts:

- Subba, D., Text book of meat and poultry technology. (Current Edition). National College of Food Science and Technology. Delta Offset Press, Thapathali, Kathmandu
- Subba, D., Practical handbook of meat, fish and poultry.(Current Edition). National College of Food Science and Technology.Delta Offset Press, Thapathali, Kathmandu
- Sharma, B.D., Meat and meat products technology. (Current edition). Jaypeebrothers medical publishers (P) Ltd, New Delhi.

Final written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	8	9	10	**Total**
Unit Hours	3	24	4	4	4	4	4	8	3	2	**60**
Marks	4	33	5	5	5	5	5	11	4	3	**80**

Storage and Packaging Technology

AG3105FD

Year: III **Total: 6 hours /week**
Semester: I **Lecture: 4 hour/week**
Practical: 2 hours/week
Lab: 0 hours/week

Course Description

This course provides knowledge of proper storage of different foods and their products along with the proper storage of different food items. This course also deals with the different physical, biological and chemical factors of grains and its products which effect the storage losses and also gives the knowledge of prevention of losses during storage. In addition to this, it provides the fundamental knowledge of compatibility of packaging materials to food.

Course Objectives

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

- Understand the types of food losses and their prevention
- Familiar with different factor which contribute the storage losses of food
- Deal the different storage methods
- Understand the principle of packaging
- Explore different type of packaging materials
- Discuss the package of food products compatibility

Course Contents

Theory

Unit 1: Storage system of major grain **2 hrs.**

1.1 Storage of food: Definition and Importance

Unit 2: Food losses and deterioration **3hrs.**

2.1 Types of losses
2.2 Factors affecting the losses
2.3 Impact of losses
2.4 Assessment of the losses
2.5 Strategy to reduce losses

Unit 3: Grain sampling **3hrs.**

3.1 Sampling: Introduction and Theory, Importance
3.2 Sampling tools and Importance
3.3 Practical methods to sampling from storage bags and containers

Unit 4: Inspection **2 hrs.**

4.1 Inspection: Importance
4.2 Inspection of store house
4.3 Hidden and surface infestation
4.4 Identification of hidden and surface infestation

Unit 5: Biology of store pests **8 hrs.**

5.1 Storage Insects: Introduction of major storage insects
5.2 Losses by storage insects

5.3 Control: Physical methods and chemical methods.
5.4 Rodents: Types found in storage, behavior, and losses by rodents
5.5 Control methods: physical & chemical

Unit 6: Fungal infestation in storage **2hrs.**

1.1 Fungi: Storage & field fungi
1.2 Mycotoxins in reference to grain and nuts

Unit 7: Grain Storage methods **3hrs.**

7.1 Bag storage methods
7.2 Bulk storage methods
7.3 Rural storage system and their improvement

Unit 8: Good storage practice **2hrs.**

8.1 Good storage practice and management

Unit 9: Scope & importance of packaging **3hrs.**

9.1 Introduction to packaging technology
9.2 Packaging: Definition, Importance, Scope, Function of packaging, types
9.3 Factors considered for Package designing

Unit 10: Hazards encountered by packaged food **2 hrs.**

10.1 Physical hazards
10.2 Chemical hazards
10.3 Biological and microbiological hazards
10.4 Environmental hazards

Unit 11: Packaging material **18hrs**

11.1 Plastic: Design, type, advantage, disadvantage, properties of Polyethylene, propylene, polyethylene terephthalate, polyvinyl chloride, polyvinylidene chloride, Polystyrene
11.2 Paper and Paperboard: Design, composition, type, advantage, disadvantage, making of paper, type of paperboard
11.3 Tin: Tin plate, composition, advantage and disadvantage, can-type, making of can
Glass container: Advantage and Disadvantage, composition, making of glass container, thermal properties of glass
11.4 Aluminum foil: Metallization, foil, aluminum can, advantages, disadvantages
Traditional packaging materials

Unit 12: Packaging of food commodities **10hrs.**

Packaging of

- Milk and milk products
- Meat and meat products including fish and egg
- Grains, legumes and cereal products
- Fruits and vegetable products
- Tea, coffee and spices
- Snacks foods
- Beverages: alcoholic and non-alcoholic beverages, carbonated and non-carbonated beverages

Unit 13: Quality control of packaging materials **2hrs.**

13.1 Quality standards & control

13.2 Regulation & laws

PRACTICAL

Practical 30hrs

Storage design of grain **2 hrs.**

- Draw the diagram of different storage system (Bin, container and retail)
- Draw the diagram of rural storage system

Determinations of physical properties of grain **6 hrs.**

- Determine
    - L, B and L/B ratio
    - Angle of repose
    - Bulk density
    - Porosity
    - 1000 kernels weight
    - Sphericity

Grading & amp; Inspection **4 hrs.**

- Demonstrate application of sampling tools
- Conduct grading of grain
- Sketch drawing of storage insects and fungi

Evaluation of Packaging Materials **8hrs.**

- Determine thickness of paper, paperboard & plastic packaging materials
- Determine gsm of paper, paperboard & plastic packaging materials
- Determine yield of paper, paperboard & plastic packaging materials
- Determine moisture content of paper & paperboard
- Determine water vapour absorption of paper & paperboard
- Determine corrugation per feet of paper board
- Determine ink adhesion of packaging materials

Test performance of packaging materials **2 hrs.**

- Determine the thermal shock of glass packaging materials
- Determine the tin coating of tin can

Visit to warehouse/rural storage structure **8 hrs.**

Recommended Texts:

- Saner D. B. (1992). Storage of cereal grains and their products 4PthP ed. AACC USA.
- Sinha R. N. and Mair W. E (1973). Grain Storage Part of a System. AVI Publishing Company USA.
- Sahay K. and Singh K.K. (2001). Unit Operations of Agricultural Processing. Vikas Publishing House India.
- Robertson Gordon L. (2013) Food Packaging Principle and Practice. Crc press USA
- Lee Dong San, Yam Kit L. and PiergiovanniLuliano (2008) Food Packaging Science and Technology. CRC press USA

Final written Exam Marking Scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	**Total**
Unit Hours	2	3	3	2	8	2	3	2	3	2	18	10	2	**60**
Marks	3	4	4	3	10	3	4	3	4	3	23	13	3	**80**

Agribusiness, Marketing and Cooperative

(AG3106PS**)**

Year: Third
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:

On completion of the course the students will be enabled 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. Discuss the effect of government intervention;
6. Calculate market efficiency.

Course Contents:

Theory

Unit 1: Introduction to Agribusiness Management: 2 Hrs.

1.1. Concept and definition of agribusiness and agribusiness management
1.2. Scope of agribusiness
1.3. Importance of agribusiness
1.4. Problem and prospects of agribusiness development in Nepal

Unit 2: Basic Concept of Firm, Plant and Industry: 2 Hrs.

2.1 Concept of firm, plant and industry
2.2 Interrelationship between firm, plant and industry

Unit 3: Agribusiness Environment: 1 Hr.

3.1 Business enabling environment

Unit 4: Organization, Management Function & Human Resource Development: 2 Hrs.

4.1 Organization and function of organization
4.2 Business management function
4.3 Managerial decision process in agribusiness
4.4 Human resource development and its function

Unit 5: Investment Appraisal Criteria 3 Hrs.

5.1 General concept of different discounting criteria of investment appraisal
5.2 General concept of different non-discounting criteria of investment appraisal

Unit 6: Risk and Uncertainty: 2 Hrs.
6.1 Concept of risk and uncertainty and their types
6.2 Management of business risk

Unit 7: Cooperative: 3 Hrs.
7.1 Definition, principle and objectives of cooperative
7.2 Cooperative farming and its importance
7.3 Cooperative marketing and its importance
7.4 Role of cooperative in agriculture commercialization

Unit 8: Introduction to Agricultural Marketing: 3 Hrs.
8.1 Concept of agricultural market and marketing.
8.2 Importance and problem of agri-marketing
8.3 Marketing vs selling approach
8.4 Difference between marketable surplus and marketed surplus
8.5 Market intermediaries

Unit 9: Marketing Functions 3 Hrs.
9.1 Primary function: assembling, processing and dispersion
9.2 Secondary Function: standardization and grading, packaging, transportation, storage, financing, risk bearing and selling
9.3 Marketing function given by Kohls and Uhl.

Unit 10: Marketing Channel and Marketing Efficiency 3 Hrs.
10.1 General marketing channels of major crops and livestock products
10.2 Price spread and producers share
10.3 Marketing Efficiency: technical, operational and price efficiency

Unit 11: Supply chain and value chain 3 Hrs.
11.1 Concept of Value Chain, Supply Chain, Backward and Forward Linkage
11.2 Supply chain management: concept, definition and importance
11.3 Value addition in the product and factors affecting in value addition of the product
11.4 Value chain map

Unit 12: Basic concept on government intervention in production and marketing 3 Hrs.
12.1 Floor price and its effect
12.2 Ceiling price and its effect
12.3 Taxation and its effect
12.4 Subsidies and its effect

PRACTICAL
Practical 15hrs
1. Describe management structure, activities, business environment, investment, profit and risk of agribusiness firm/company / cooperative. 2 hrs.
2. Identify major institutions and their roles related to agricultural product markets in Nepal. 2 hrs.
3. Appraise financial status of agriculture project by discounted criteria (NPV, B/C ratio, IRR) and non-discounted criteria (PBP, SRR, ROI). 3 hrs.

4. Identify major business risk and safeguard majors. 1 hrs.
5. Discover value chain map, backward linkage and forward linkage of HVC's. 2 hrs.
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.
7. Identify various marketing functions operated by the market intermediaries (collector, trader, processor) 2 hrs.

Recommended Texts:

- Acharya, S.S. & Agarwal, N.L. (2011). *Agricultural marketing in India* (5th ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Pandey, M., & Tewari, D. (2010). *The Agribusiness book: Marketing and value chain perspective*. IBDC Publisher, New Delhi.
- Broadway, A.C., & Broadway-Arif, A.A. (2008). *Textbook of agribusiness management*. Kalyani Publisher, New Delhi, India.
- Zimmerrer, T.W. & Scarborough, N.M. (2009). *Essentials of entrepreneurship and small business management.* Pearson Education.

Final written Exam Marking Scheme

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

Third Year/Semester: II

Entrepreneurship Development
EG 3201 MG

Year: III **Total: 5 Hrs. /week**
Semester: II **Lecture: 3 Hrs./week**
Tutorial: Hr./week
Practical: 2 Hrs./week
Lab: Hrs./week

Course Description:
This course is designed to provide the knowledge and skills on formulating business plan and managing small business. The entire course deals with assessing, acquiring, and developing entrepreneurial attitude; skills and tools that are necessary to start and run a small enterprise.

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

- Understand the concept of business and entrepreneurship;
- Explore entrepreneurial competencies;
- Analyze business ideas and viability;
- Learn to formulate business plan with its integral components and
- Manage small business.

Course Contents:
Theory

Unit 1: Introduction to Business & Entrepreneurship: 9 Hrs.

1.1 Overview of entrepreneur and entrepreneurship
1.2 Wage employment, self- employment and business
1.3 Synopsis of types and forms of enterprises
1.4 Attitudes, characteristics & skills required to be an entrepreneur
1.5 Myths about entrepreneurs
1.6 Overview of MSMEs (Micro, Small and Medium Enterprises) in Nepal

Unit 2: Exploring and Developing Entrepreneurial Competencies: 9hrs

2.1 Assessing individual entrepreneurial inclination
2.2 Assessment of decision-making attitudes
2.3 Risk taking behavior and risk minimization
2.4 Creativity and innovation in business
2.5 Enterprise management competencies

Unit 3: Business identification and Selection: 4 Hrs.

3.1 Sources and method of finding business idea(s)
3.2 Selection of viable business ideas
3.3 Legal provisions for MSMEs in Nepal

Unit 4: Business plan Formulation: 18 Hrs.

4.1 Needs and importance of business plan
4.2 Marketing plan
- Description of product or service
- Targeted market and customers
- Location of business establishment

- Estimation of market demand
- Competitors analysis
- Estimation of market share
- Measures for business promotion

4.3 Business operation plan
- Process of product or service creation
- Required fix assets
- Level of capacity utilization
- Depreciation & amortization
- Estimation office overhead and utilities

4.4 Organizational and human resource plan
- Legal status of business
- Management structure
- Required human resource and cost
- Roles and responsibility of staff

4.5 Financial plan
- Working capital estimation
- Pre-operating expenses
- Source of investment and financial costs
- Per unit cost of service or product
- Unit price and profit/loss estimation of first year

4.6 Business plan appraisal
- Return on investment
- Breakeven analysis
- Risk factors

Unit 5: Small Business Management: 5 Hrs.

5.1 Concept of small business management
5.2 Market and marketing mix
5.3 Basic account keeping

PRACTICAL

Practical 30 hrs

Unit 1: Overview of Business & Entrepreneurship ` 2 Hrs.

1. Collect business information through interaction with successful entrepreneur

Unit 2: Exploring and Developing Entrepreneurial Competencies 2 Hrs.

- Generate innovative business ideas

Unit 3: Product or service Identification and Selection 2 Hrs.

1. Analyze business ideas using SWOT method

Unit 4: Business Plan Formulation 22 Hrs.

1. Prepare marketing plan
2. Prepare operation plan
3. Prepare organizational and human resource plan
4. Prepare financial plan
5. Appraise business plan
6. Prepare action plan for business startup

Unit 5: Small Business Management 2 Hrs.

1. Prepare receipt and payment account
2. Perform costing and pricing of product and service

Project Work
AG3202FD

Year: III **Total: 11/weeksHours**
Semester: II **Theory: 0/weeks Hours**
Practical: 11/weeks Hours

Course Description

This course covers fundamental aspects of project work applied in real field. Students can select the project topic and submit the proposal to the evaluation team of the respective institution and initiate the project work with the acceptance of proposal from the evaluation team. Students practice techniques involved in preparing the project proposal, execution of proposed project work and its analysis along with final project report development.

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

- Practice the basic skill and attitude of project work
- Execute project concept into action
- Assess the market potentiality of the project
- Write project report and its presentation

PRACTICAL
Project writing:

1. Project work topic selection

Project topic can be related to any one of the area mentioned below:

- the technology of food Products (Cereal, bakery and confectionery/ fruits and vegetables/ beverages and spices/ Meat, Poultry and fish)
- Dairy Technology (Milk and milk products, milk processing)
- Fermentation technology
- Food Preservation
- Food Microbiology (Quality evaluation/microbiological analysis of food)
- Food and Dairy chemistry
- Food analysis
- Storage and packaging
- Production/Preparation of any food product
- Indigenous food products
- Food safety and quality control
- Food plant layout
- Food engineering
- Food processing
- Novel foods and technology
- Combination of any of the areas mentioned above

2. Proposal writing
3. Carry out the project work
4. Report writing
5. Presentation of the report
6. Final submission of report
7. Evaluation by the team on the basis of project work, writing and presentation

In-Plant Training
AG3203FD

Year: III **Total: 360 hours**
Semester: II **Lecture: hours/week**
Tutorial: hour/week
Practical: 24 hours/week
Lab: hours/week

Credit Hours: 0+24
Full Marks: Practical 360

Course Description
The In-Plant Training is a 3-month (12 weeks/ 72 working days) program that aims to provide students an opportunity for meaningful career related experiences by working fulltime in real organizational settings where they can practice and expand upon their classroom based knowledge and skills before graduating. It will also help students gain a clearer sense of what they still need to learn and provides an opportunity to build professional networks.

General objectives:
The objective of the In-Plant Training is to make students familiar with/ gain firsthand experience of the world of work as well as to provide them an opportunity to gain skills that are new or not covered in the institute.

Course Objectives
The objective of the In-Plant Training is to help students to:

- Apply knowledge and skills learned in the classroom in actual work settings or conditions and develop practical experience before graduating.
- Acquire deeper knowledge of the industry in which the work is done.
- Gain an opportunity to work effectively with professional colleagues and experience their activities and functions.
- Develop specific, vocational and personal skills as well as learn those disciplines, skills and attitudes which can be best learnt on the job.
- Gain an opportunity to strengthen portfolio or resume with practical experience and projects.
- Gain a learning experience that could even lead to entry level job opportunities within the company.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Obtain an opportunity to increase level of maturity and grasp of work culture.
- Establish professional contacts and network.
- Identify areas for future knowledge and skill development.

Requirements for successful completion of the in-plant training:

- Satisfactory completion of 12 weeks (3 months) of the In-Plant Training in an approved organization as attested by the concerned official of the organization.
- Preparation and submission of In-Plant Training report within 2 weeks of completion.
- Approval of the submitted In-Plant Training report by the College's Supervisor.
- At least 60% % marks secured out of 100.

Activity:

In this program the students will be placed in the job market under the supervision of supervisors in the organizations such as food industries (biscuits, bread, meat, fats and oil, rice, wheat, legumes and maize mills, beverage, fruits and vegetables, noodles, snacks, confectionaries, brewery and distilleries, tea, coffee, spices, winery, water processing, sugar refineries) and dairy industries as well as regulatory government and non government agencies, and academic institutions. The nature of work is practical and the duration will be of three 12 weeks (480 hours). The student will be eligible for In-Plant Training only after the completion of all classes of the subjects included in the curriculum. In-Plant Training should be completed at least 2 weeks before the start of 3rd year final examination of CTEVT. The institute will make arrangement for In-Plant Training. The institute will inform the CTEVT at least one month prior to the In-Plant Training placement date along with plan, schedule, the name of the students and their corresponding In-Plant Training site.

A) Complete In-Plant Training Plan

SN	Activities	Duration	Remarks
1	Orientation	2 days	Before In-Plant Training placement
2	Report to the site	1 days	Before In-Plant Training placement
3	Actual work at the WEP site	90 days/480 hours	During In-Plant Training period
4	Mid-term evaluation	one week (for all sites)	After 6 to 7 week of In-Plant Training start date
5	Report to the parental organization	1 days	After In-Plant Training placement
6	Final report preparation	5 days	After In-Plant Training completion
7	Seminar/ evaluation from CTEVT or its nominee(external)	3 days	After 10 days of completion of In-Plant Training

- After 6 weeks of In-Plant Training placement mid-term evaluation should be made by the institute or jointly with CTEVT.
- After completion of 3 months In-Plant Training period, students will be provided with one-week period to review all the works and prepare a comprehensive final report.
- In-Plant Training seminar date and time will be fixed by the institute after one week of the completion of In-Plant Training by making consent with the CTEVT.
- Final evaluation will be made according to the marks at the following evaluation scheme but mid-term evaluation record will also be considered.

B) Evaluation scheme:

Evaluation and mark distribution is as follows:

S.N.	Who does evaluate?	Marks
1	Supervisor of the organization in which the student is placed for In-Plant Training	100
2	The Training Institute	100
3	CTEVT or its nominee (external)*	100
	Total	**300**

*** Students are required to secure 50 percent marks in the external examination conducted by CTEVT to pass the course.**

Acknowledgements

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