CURRICULUM

DIPLOMA IN FORESTRY

(Three year program- Yearly system)

Council for Technical Education and Vocational Training

Curriculum Development Division

Sanothimi, Bhaktapur

Developed in 2007

First Revision, 2013

Second Revision, 2019

Table of Content

Introduction

This curriculum is designed for producing middle level forestry technical human resources (Ranger) required for livelihood improvement of community through the participatory methods in association with the community forestry user groups and other sub sectors like integrated watershed management, wildlife and protected area management.

The 3 years Diploma in Forestry curricular programme is designed for producing forestry service providers as professional equipped with required knowledge, skills and attitudes. It insists on addressing second-generation issues of present forestry sector such as in community forestry management, soil conservation and watershed management, wild life and protected area management.

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 Forestry including community forestry, soil conservation and watershed management, wild life conservation and protected area management.

The **Diploma in Forestry** course extends over 3 years. The first year focuses on basic sciences and fundamental subjects related to forestry, the second year focuses on forestry related disciplinary subjects, and the third year insists on disciplinary subjects as well as the application of learned skills and knowledge through the work experience program (WEP).

The foundational subjects like Physics, Chemistry, Zoology, Botany and Mathematics being offered in diffusion model of curricular program are applicable in the field of forestry. It also includes language subjects like Nepali and English applicable for the communication in the same area. The course structure and the subject wise content that reflect the details of this curriculum. In brief, this curriculum will guide to its implementers to produce competent and highly employable middle level technical workforces in the field of forestry.

The content of individual subjects prescribed in the curriculum is incorporated in the light of "must know and must do" and further elaborated with "should to know and should to do" principle of knowledge and skills for this level.

Rational

Diploma in Forestry curriculum was last revised in 2013. This is the second revision after the implementation of its first revision. The rationales behind its revision are as follows:

- It crossed the 5 years maturity period of its implementation after the 1st revision and similarly the implementing agencies/college have requested to revise this curriculum based on their teaching experiences.
- The year-wise re-adjustments of the existing subjects are felt necessary.
- The existing curriculum partially addresses the 2nd and 3rd generation issues of forestry sector and need to be revised.
- It is needed to revisit its weightage in both theory and practical marks contents to make it more practical oriented.
- The 3 month long field practical model in 3rd year seems complicated and needs to be specified.

Furthermore, technology of forestry occupation upgraded rapidly in the recent year. With the advent in technology trained technicians are needed throughout the world. To cope with the national and international demand, the knowledge and the skills should be updated to make the skills relevant and pertinent to the industry. Hence this curriculum is revised to equip the students as per the changing technology in changing environmental context.

Curriculum Title
Diploma in Forestry (DIF)

Aim
The program aims to educate and train the quality middle level forestry technical personnel required for livelihood improvement of community through the participatory methods in association with the community forestry user groups.

Programme Objectives
This curriculum has the following objectives to:

1. prepare forestry technicians who are able to work as ranger in different level of forestry related government and nongovernment organizations
2. produce quality human resources to provide effective technical and managerial services in public and private forests as well as protected areas
3. develop competency in forestry enterprises
4. provide extensive field based experiences to meet specific and growing needs of different forestry stakeholders
5. prepare such technical workforce who will demonstrate positive attitude and respect for the profession and socio-cultural values
6. create self-employment opportunities immensely

Group Size
The group size will be maximum of 40 (forty) in a batch.

Entry Criteria
1. SLC Pass or SEE with minimum C grade in two subjects and D+ grade in one subject among Compulsory Mathematics, English & Science.
2. TSLC in Forestry with minimum 67%.
3. Should pass entrance examination as administered by CTEVT.

Duration
The total duration of this curricular program is three years. The program is based on yearly system. Moreover, one academic year consists of maximum of 39 academic weeks and one academic week consists of maximum 40 hours excluding evaluation period.

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:

1. Overall ratio of teacher and student must be 1:10 (at the institution level).
2. Teacher and student ratio for practical demonstration 1:10
3. Minimum of 75% of the teachers must be fulltime.

Qualification of Teachers and Instructors

1. The program coordinator must be a master degree holder in any field but having atleast Bachelor's degree in Forestry with minimum of 3 years experience in teaching activities or services after completion of Bachelor's degree.
2. The disciplinary subject related teacher must be a bachelor degree holder in related field.
3. The demonstrator must have an intermediate level degree in related field with minimum of 2 years experience in teaching activities.
4. The foundational subject related teacher should be master degree holder in the related area.

Instructional Media and Materials

The following instructional media and materials are suggested for the effective instruction and demonstration.

1. ***Printed Media Materials*** **(**assignment sheets, case studies, handouts, information sheets, individual training packets, procedure sheets, performance checklists, and textbooks).
2. ***Non-projected Media Materials*** (display, models, flip chart, poster, writing board).
3. ***Projected Media Materials*** (opaque projections, multimedia projectors, slides).
4. ***Audio-Visual Materials*** (audiotapes, films, slide-tape programs, videodiscs, videotapes).
5. ***Computer-Based Instructional Materials*** (computer-based training, interactive video).

Teaching Learning Methodologies

The methods of teachings for this curricular program will be a combination of different approaches (not limited to as mentioned here) such as illustrated lecture, tutorial, group discussion, demonstration, simulation, guided practice, practical experiences, fieldwork, report writing, term paper presentation, community campaign, case analysis, role-playing, experiment, project work and other independent learning.

Theory: Lecture, tutorial, discussion, seminar, interaction, assignment, group work.
Practical: Demonstration, simulation, observation, guided practice, self-practice, project work, fieldwork, case analysis, role-play, experiment, report writing.

Mode of Education

There will be inductive and deductive mode of education.

Examination and Marking Scheme

a. Internal assessment

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

b. Final examination

- Weightage of theory and practical marks are mentioned in structure.
- Students must pass in all subjects both in theory and practical for certification. If a student becomes unable to succeed in any subject s/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 instructor must evaluate final practical examinations.
- One evaluator in one setting can evaluate not more than 20 students.
- Practical examination should be administered in actual situation on relevant subject with the provision of at least one internal evaluator from the concerned or affiliating institute led by external evaluator nominated by CTEVT.
- Provision of re-examination will be as per CTEVT policy.

d. Final practicum evaluation will be based on:

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

Note: The evaluation and marking schemes for the subjects comprehensive field practice/study are mentioned separately in the respective sections of the curriculum.

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 of each subject to appear final examination.

Provision of Back Paper

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

Disciplinary and Ethical Requirements

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

Grading System

The following grading system will be adopted:

1. Distinction: 80% and above
2. First division: 65% to below 80%
3. Second division: 50 % to below 65%
4. Pass division: Pass marks to Below 50%

Certification and Degree Awards

1. Students who have passed all the components of all subjects of all 3 years are considered to have successfully completed the course.
2. Students who have successfully completed the course will be awarded with a degree of **"Diploma in Forestry".**

Career Opportunity

The graduates will be eligible for the position equivalent to Non-gazette 1st class (technical) as Ranger or as prescribed by the Public Service Commission of Nepal and other related agencies. The graduate will be eligible for registration with the related Council in the grade as provisioned in the related Council Act (if any) and they are also eligible to apply for the entrance examination for the B.Sc. Forestry study organized by the respected universities.

Question Patterns for Final Written Exam

The question patterns for written exam are suggested as follows;

A. For subject with full marks 80

S. N.	Type of question	No of question	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	3	8	24	54 min	1
2	Short	8	4	32	72 min	2
3	Very short	12	2	24	54 min	2
	Total	**23**		**80**	**180 min**	

B. For subject with full marks 60

S. N.	Type of question	No of question	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	3	6	18	54 min	1
2	Short	8	3	24	72 min	2
3	Very short	9	2	18	54 min	2
	Total	**20**		**60**	**180 min**	

C. For subject with full marks 40

	Type of question	No of question	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	2	6	12	27 min	1
2	Short	4	4	16	36 min	1
3	Very short	6	2	12	27 min	1
	Total	**12**		**40**	**90 min**	

Course Structure (Diploma in Forestry)

First year

SN	Subject	Mode		Weekly hours	Distribution of Marks						Total Marks
					Theory			Practical			
		T	P		Int.	Final	Time	Int.	Final	Time	
1	English	4	-	4	20	80	3	-	-	-	100
2	Nepali	4	-	4	20	80	3	-	-	-	100
3	Social Studies	2	-	2	10	40	1.5	-	-	-	50
4	Physics	3	2	5	15	60	3	10	15	3	100
5	Chemistry	3	2	5	15	60	3	10	15	3	100
6	Zoology	3	2	5	15	60	3	10	15	3	100
7	Botany	3	2	5	15	60	3	10	15	3	100
8	Mathematics and Statistics	3	2	5	15	60	3	10	15	3	100
9	Computer Application	2	2	4	10	40	1.5	20	30	3	100
	Total	**27**	**12**	**39**	**135**	**540**		**70**	**105**		**850**

Second Year

SN	Subject	Mode		Weekly hours	Distribution of Marks						Total Marks
					Theory			Practical			
		T	P		Int.	Final	Time	Int.	Final	Time	
1	Silviculture	3	2	5	15	60	3	10	15	3	100
2	Wildlife and Protected Area Management	3	2	5	15	60	3	10	15	3	100
3	Soil and Water Conservation Management	3	2	5	15	60	3	10	15	3	100
4	Community Forestry	3	2	5	15	60	3	10	15	3	100
5	Forest Measurement	3	2	5	15	60	3	10	15	3	100
6	Non-timber Forest Products (NTFPs)	3	2	5	15	60	3	10	15	3	100
7	Forest Harvesting and Utilization	3	2	5	15	60	3	10	15	3	100
8	Agroforestry	3	2	5	15	60	3	10	15	3	100
	Total	**24**	**16**	**40**	**120**	**480**		**80**	**120**		**800**

Third Year

SN	Subject	Mode		Weekly hours	Distribution of Marks						Total Marks
					Theory			Practical			
		T	P		Int.	Final	Time	Int.	Final	Time	
1.	Forest Protection	3	2	5	15	60	3	10	15	3	100
2.	Forest Management	3	2	5	15	60	3	10	15	3	100
3.	Extension Education	3	2	5	15	60	3	10	15	3	100
4.	Forest Policy, Law	2	0	2	10	40	1.5	0	0	-	50
5.	Forest Surveying and Engineering	3	2	5	15	60	3	10	15	3	100
6.	Entrepreneurship Development	3	2	5	15	60	3	10	15	3	100
7.	Office Management	2	0	2	10	40	1.5	0	0	-	50
8.	Work Experience Program (WEP)	-	10	10	0	0	-	100	100	-	200
	Total	**19**	**20**	**39**	**95**	**380**		**150**	**175**		**800**

First Year Subjects

1. **English**
2. **Nepali**
3. **Social Studies**
4. **Physics**
5. **Chemistry**
6. **Zoology**
7. **Botany**
8. **Mathematics and Statistics**
9. **Computer Application**

English

Total hours: 156 **Full Marks: 100**
Theory: 156

Course Description
This is a general course of the English language for the diploma level in Forestry. The course integrates different aspects and skills of English in it as it views language as a medium for communication and as a means to knowledge. It provides the students with techniques in the use of English for academic and communicative purposes. It also equally intends to enable the students to provide practical skills in performing various language functions. Besides, the reading component includes a variety of literary texts on the contemporary issues of global interest .The writing part aims at developing various writing skills required for effective communication on matters of general and academic interest**.**

Course Objectives
On completion of this course, students will be able to:

- use English structures and vocabulary in constructing real-life discourse
- demonstrate skills in the use of English for academic as well as communicative purposes
- appreciate the literary texts and develop an interest in them to read similar materials independently and,
- demonstrate skills in effective communication through writing

Recommended Textbooks

1. Doff A, C. Jones and K. Mitchell (1997) Meanings into Words. Cambridge : CUP
2. Student's book
3. Workbook
4. Savage A and Mayer P (2012), Effective Academic Writing. Oxford University Press
5. Lohani, S.P. and R.P. Adhikary (1997) The Magic of Words, Kathmandu : M.K. Publishers

Course Contents

Unit 1: Academic writing	**Hrs 36**
Objectives	Contents
Focus on academic writing	Paragraph to short Essay Descriptive Essays Narrative Essays Comparison contrast Essays Opinion Essays Cause and effect Essays
Evaluation methods: written exams, internal assessment, and performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, solving related problems and classroom exercises.
Unit 2 : Language structures and functions	**Theory Hrs. 56**
Objectives	Contents

2.1 **Places** Say precisely where things/places are. Talk about services. Describe and ask about amenities in towns.	There is/are... Have/have got Location prepositions Have something done Non- defining relative clauses Vocabulary: rooms and furniture, places that provide services and associated verbs, names of amenities
2.2 **Decisions and intentions** Make spontaneous decisions Express intentions and plans Come to a decision with someone else Talk about definite arrangements in future	Will, going to, planning to, thinking of, intending to Shall we...? Why. -Shall we...? Let's... Why don't we...? Is/am/are + v-ing (present continuous)
2.3 Past events Relate and ask about past events Say when events happened Tell the history of people and places	Sequence expressions Past simple tense: negatives and questions Time expressions with and without prepositions Past simple passive
2.4 Talking about now Talk about what is happening at the moment Talk about long -term changes in progress Talk about current activities	Present continuous tense and its different forms
2.5 Request and offers Ask people to do and not to do things Ask for permission to do things Offer to do things and to let people do things Report requests and offers.	Structures for: Making requests, Seeking permission Making offers 'Reporting requests and offers'
2.6 Recent actions and activities Talk about recent past actions and their results Talk about recent activities and achievements	Different forms of present tense and past simple tense
2.7 Events and circumstances Relate past events to their circumstances Talk about the consequences of past events Talk about anything seen heard and felt in the past	Past simple and past continuous Present perfect and past tenses Verbs of perception+ infinitive/+ -ing
2.8 Leisure activities and skills Talk and ask about leisure activities Say how much one does of a particular activity Talk and ask about skills	Questions about activities Expression of quantity Skill expressions Vocabulary related to sports and hobbies

2.9 Advice Suggest solutions to particular problems Advise people to take precautions Give general advice	Basic advice structures Reporting advice Try + -ing Structures for advising people to take precautions General advice structures
2.10 Origin and duration Talk about the origin of present situations Talk about the duration of present situations Say how long it is since things happened	'Origin' structures 'Duration' structures 'Since' with clauses Negative origin and durations
2.11 Similarities and differences Talk about similarities and differences Say what one has in common with other people Say how one is different from other people Classify things according to similarities and differences	‘Both ...and.' and 'neither... nor’. Positive and negative agreement structures 'Myself' Both, neither, either whereas
2.12 Degree Talk about excess and inadequacy Say what is wrong with things Express degree by talking about results	‘Too' and 'enough' with or without infinitive 'So' and 'such'
2.13 Criticising Say what is wrong with present situations Criticise people's present behaviour Criticise past actions and events Speculate about imaginary situations Blame people for what has happened Evaluation method s or teaching learning activities or resources for unit II ?	Should/shouldn't If + past tense If + had (n't) done/had(n't) been doing Keep v-ing/be +v- ing
2.14 Obligation Models of obligation and permission, “make”and “let” ; “ freedom of choice” structures	Obligation structures Permission structures “Make” and “let” Habitual obligation and Permission in the past Freedom of choice
Unit 3: Extensive Reading and Writing	Theory Hrs. 64
Objectives	Contents

Have a general understanding of the prescribed texts related to different literary genres. Answer the questions based on the reading texts. Produce different types of free compositions	Reading texts **Stories** The Recurring Dream The Lost Doll The House Call **Fear** The Loving Mother A Worn Path (Eudora Welty) The Three Day Blow (Ernest Hemingway) The Gardener (Rudyard Kipling) **Poems** My Heart Leaps up when I Behold (William Wordsworth) The Poplar Field (William Cowper) Keeping Things Whole (Mark Strand) On the Vanity of Earthly Greatness (Arhur Guiterman) **Essays** Speaking of Children...(Barbara Holland) Look at a Teacup (Patricia Hampl) The Nightmare Life without Fuel (Isaac Asimov) Unchopping a Tree (W. S. Merwin) **Play** Malini (Rabindranath Tagore)
Evaluation methods: written exams, internal assessment, and performance observation.	**Teaching/learning activities and resources:** classroom instruction and demonstration, solving related problems and classroom exercises

नेपाली

पाठघण्टा : १५६ **मूल्याङ्न अंक : १००**

यो पाठ्याशं डिप्लोमा (वन विज्ञान) तहमा अध्ययन गर्ने विद्यार्थीहरुका लागि नेपाली भाषाको व्याकरणात्मक ज्ञान र सुझको विकासका साथै पठनबोध र अभिव्यक्ति क्षमताको विकास गर्ने दृष्टिले राखिएको हो यसलाई मुख्यत: दुई खण्डमा बाँडिएको छ : व्याकरण खण्ड र बोध (अभिव्यक्ति) खण्ड । व्याकरण अन्तर्गत वर्ण, वर्णविन्यास, शब्दवर्ग, रुपायन, शब्द निर्माण र वाक्यसम्बन्धी पाठ्यवस्तुहरु राखिएका छन् भने बोध अभिव्यक्ति अन्तरर्गत सामान्यवा्ध र बोध/सार्थ प्रयोजनपरक वोधका अभिव्यक्ति रचनाका लागि अपेक्षित सीपहरु र समीक्षाका लागि साहित्यिक विधाका पाठहरु समाविष्ट छन् ।

पाठ्याशंको उद्देश्य :

यो पाठ्याशं पूरा गरेपछि विद्यार्थीहरु निम्नलिखित कुरामा सक्षम हुनेछन् :
कथ्यभाषा र लेख्यभाषा बीचको भिन्नता पहिल्याउन ।
अभिव्यक्तिमा प्रयोगहुने शब्दहरुको उपयुक्त वर्णविन्यास लेख्न ।
शब्दहरुको वर्ग-पहिचानगर्न, रुपायन गर्न र निर्माण गर्न ।
वाक्यातत्व र वाक्यान्तरणका कडीहरु बुझेर आफ्ना अभिव्यक्तिमा तिनको उपयूक्त प्रयोग गर्न ।
खास वाक्यतत्वसँग सम्बद्ध ढाँचा र सन्दर्भका आधारमा अनुच्छेद रचना गर्न,
स्तर अनुरुप पाठ्यसामग्रीमा प्रयुत्त: शब्दहरुका आधारमा शब्दभण्डारको विस्तार गर्न
बोध र संक्षेपीकरणका पाठ्यसामग्रीमा प्रयुक्त शब्दहरुका आधारमा शब्दभण्डारको विस्तार गर्न ।
ज्ञान विज्ञानका विभिन्न शीर्षकहरुमा स्वतन्त्र रुपमा अनुच्छेद र निबन्ध रचना गर्न ।
तोकिएको आधारमा साहित्यिक कृतिहरुको समीक्षा गर्न ।

खण्ड क : नेपाली व्याकरण

पाठघण्टा: ८०

एकाइ	पाठ्य विषयको विवरण	पाठ घण्टा
१.	**वर्ण र वर्णविन्यास**	२०
	क) उच्चार्य वर्णहरुको परिचय :स्वर र व्यञ्जन वर्णहरु देवनागरी लिपि र उच्चार्य नेपाली वर्णहरु नोपाली अक्षरहरुको संचरना	१०
	ख) वर्ण विन्यास : कथ्य र लेख्य नेपाली भाषमा भिन्नता ह्रस्व-दीर्घ (इ, उ), स/श/ष, ब/व, व/ओ, य/ए, ऋ/रि, क्ष/छे, क्ष्य/छ्य, शिरविन्दु र चन्द्रविन्दु, हलन्त, पदयोग र पदवियोग तथा लेख्य चिन्ह सम्बन्धी अशुद्धि संशोधन अभ्यास	१०
२.	**शब्दवर्ग, शब्द रुपायन र शब्दनिर्माण**	३१
	क) शब्दवर्ग- नाम, सर्वनाम विशेषण, क्रियापद, नामयोगी, क्रियायोगी, संयोजक, विस्मयाधिवोधक र निपातहरुको पहिचान- अभ्यास ।	६
	ख) शब्दरुपायन-नाम, सर्वनाम र विशेषणको लिङ्ग, वचन, आदर, कारकका, आधारमा तथाक्रियापदको लिङ्ग, वचन, परुष, आदर, काल, भाव, वाच्य, र अकरणका आधारमा शब्दरुपायनको अभ्यास	६
	ग) शब्द निर्माण अभ्यास निम्नलिखित उपसर्गहरुद्धारा शब्दनिर्माणको अभ्यास प्र अप, सम्, अनु, वि, अधि, उत, प्रति, परि, उप, सु, नि, निर, दुर, अ, अन, कु । निम्नलिखित कृत् प्रत्यद्धारा शब्दनिर्माणको अभ्यास आइ, आली, इया, इलो, ई, ए, एली, ली, ले । इक, ई, ईय, इत, ता, त्व, मान, वान, आलु । समस्त शब्दहरुको पहिचान र तत्पुरुष, कर्मधारण, द्विगु, द्वन्द, अव्ययीभाव र वहूब्रीहिको प्रक्रियावाट समस्त शब्दहरुको निर्माण गर्ने अभ्यास : पुर्ण आंशिक र अपरिवर्तित द्वित्व-प्रक्रियावाट शब्दनिर्माणको अभ्यास वन र कृषि संग सम्बन्धी प्राविधिक शब्दहरुको ज्ञान, अभ्यास, अर्थ लेख्ने र अर्थ खुल्नेगरि वाक्यमा प्रयोग गर्ने ।	१९

	अम्ल वर्षा, कृषिवन, वायुपरागसेचन, सपुष्पक, , स्वपोषित, काई (हरितमल), जैविक विविधता, जिवोर्जा, ब्रण, , जलाधार, हरितकरण, उडुवा, , सहाधिरोही, , समोच्च रेखा, प्रसृतलता, छत्राग्नि, अपुष्पक, अवतारण, अवशेष, पतझर, विखण्डन, पत्रावतारक, निरावरण, विविधता, प्रवल, अधिरोही रुख, बगाहन, परिस्थितिक प्रणली, पारितन्त्र, अतिक्रमण, संङ्कटापन्न, रैथाने, कीटविज्ञान, परारोही, वाष्पोत्सर्जन, विलोपन, लोपहुनु, जननक्षमता, निषेचन, उर्वरक, , खाद्य-स्तूप, , जीवाश्म, अनुवंश, बीजाङ्कुरण, भू-आवरण, वृद्धि रेखा, वृद्धिचक्र, अपुष्पक, वासस्थान, कठोरीकरण,छायार्थी, उद्भिज, शाकाहारी, बागवानी, परपोषी, वर्णशङ्कर, अभिवृद्धि, कीटाहारी, अन्तररोपण, , भू- स्वमित्व, भू- आकृति, भूस्खलन, , पर्णरेखा, प्रकाशार्थी, , मश्रित वाली, अनुगमन, , उत्प्रेरणा, उद्यान/बगैंचा, चरिचरन, पुष्पद्भिद्, दीप्तिकालिक, प्रकाशसंश्लेषण, प्रकाशानुवर्ती, प्रकाशानुवर्तन, परिवहन, परागसेचन, परभक्षि, छिमल्नु, दुर्लभ, , , संशोषण, अवसादन, निष्पतन, अवस्रवण, छायार्थी, प्रजाति, चाङ्ग, अनुक्रमण, सर्वेक्षण, सहजीवन, सहजीविता, टङ्गिया, प्रादेशिकता, ,उत्स्वेदन, , वृक्ष, जलाधार, अपक्षय, अरण्याभूमि,	
३	**बाक्य तत्व बाक्यान्तरण र अनुच्छेद- रचना**	२९
	क) लिङ्ग, वचन, पुरुष, र आदरका आधारमा कर्ता र क्रियापदका विचको सङ्गति सम्बन्धी अभ्यास विशेष्य-विशेषण र नाम-सर्वनामको बीचको सङ्गति सम्बन्धी अभ्यास विभक्ति-नियम तथा ले, लाई, देखि, वाट, द्धारा, को, का, की, रो, रा, री, नो, ना, नी, मा आदि विभक्ति प्रयोगको अभ्यास सरल र तिर्यक् विभक्तिनियमको अभ्यास	७
	ख) वाक्यान्तरण: १) विभिन्न, काल, पक्ष, भाव, अकरण, वाच्य, प्ररणर्थक आदिमा वाक्यान्तरण गर्ने अभ्यास २) वाक्य-सश्लेषण र विश्लेषणको अभ्यास	७
	ग) अनुच्छेद-रचना लिङ्ग, वचन, पुरुष आदर, काल, पक्ष, भाव, अकरण, वाच्य, प्ररणर्थक,आदिका आधारमा खास, सन्दर्भ, वा विषय भित्र, रही निम्नलिखित दुई किसिमको अनुच्छेद रचना गर्ने अभ्यास निर्दिष्ट वाक्य-ढाँचामा परिवर्तन गरी अनुच्छेद रचना गर्ने अभ्यास: खास वाक्यत्तत्व सँग सम्बद्ध सन्दर्भ वा विषयमा आधारित भएर अनुच्छेदहरु लेख्ने अभ्यास	१५

खण्ड ख : बोध तथा अभिव्यक्ति

पाठघण्टा : ७६

एकाइ	पाठ्य विषयको विवरण	पाठ घण्टा
१.	बोध र शब्द भण्डार गद्यांशहरुको वोध र शब्दभण्डारको अभ्यास संक्षेपिकरण :	१०
२.	बुँदा, टिपोट गरी संक्षेपीकरण गर्ने अभ्यास अनुच्छेद लेखन ज्ञान विज्ञान र प्रविधिसँग सम्बन्धीत विभिन्न विषय शीर्षकहरुमा अनुच्छेद लेख्ने अभ्यास	७
३.	निवन्ध लेखन निवन्ध योजना र सो सँग सम्वन्धीत बुँदा अनरुप अनुच्छेद गठनको अभ्यास वस्तुपरक र भावपरक निवन्ध लेखनको अभ्यास कृति समीक्षा :	९
४.	विषयवस्तु, कथानक, पात्र, परिवेश, सन्देश, शीर्षक र भाषा शेलीका आधारमा निम्नलिखित रचनाहरुको समीक्षात्मक अभ्यास : कथा : गुरु पसाद मैनाली छिमेकी विश्वेश्वरप्रसाद कोइराला सिपाही	१०
५.	भवानी भिक्षु हारजीत इन्द्र वहादुर राई रातभरी हुरी चल्यो रमेश विकल मधुमालतीको कथा निवन्ध : लक्ष्मी प्रसाद देवकोटा वीरहरु	४०

	श्यामप्रसाद शर्मा आइमाई साथी भैरव अर्याल महापुरुषको संगत कविता : लेखनाथ पौडेल नैतिक दृष्टानत लक्ष्मीप्रसाद देवकोटा वन गोपाल प्रसाद रिमाल परिवर्तन माधव प्रसाद घिमिरे यही हो मेरो मिथिला भूपि शेरचन मेरो देश नाटक : विजय मल्ल वहुला कजीको सपना	

पाठ्यपुस्तक तथा सहायक पुस्तकहरु :

१. मोहनराज शर्मा, शब्दरचना र वर्ण विन्यास वाक्यतत्व र अभिव्यक्ति, काठमाण्डौ बुक सेन्टर, काठमाण्डौ ।
२. त्रि.वि.पाठ्यक्रम विकास केन्द्र, अनिवार्य नेपाली शिक्षण निर्देशन, काठमाण्डौं
३. कृष्ण प्रसाद पराजुली, नेपाली अध्ययन तथा अभिव्यक्ति। रत्न पुस्तक भण्डार, काठमाण्डौं ।
४. लीलानाथ सुवेदी, अनिवार्य नेपाली अभ्यास पूस्तिका, र्टधित सामग्री ।
५. हरि प्रसाद पराजुली, तुलसी राम श्रेष्ठ, अनिवार्य नेपाली, नवकला पब्लिकेशन, काठमाण्डौ ।

Social Studies

Total Hours: 78 **Full Marks: 50**

Course Description

This course offers an introduction to Nepal in general. It provides basic information about the geography, natural resources, history, society, culture, politics, economy, and foreign policy of Nepal. Analyses of current social and national problems are discussed with relation to these country features.

Course Objectives

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

- Identify the climate, geography, natural resources and administrative units of Nepal.
- Summarize the history of Nepal.
- Describe the society, culture and arts of Nepal.
- Explore the social problems challenges in Nepal.
- Analyze the salient features and difficulties of Nepalese people in economic development.
- Distinguish between democratic and non-democratic forms of government.
- Examine the features of the constitution of the Federal democratic Republic Nepal, 2072.
- Summarize the political development in Nepal.

References

- Faces of Nepal, Jagadamba Press.
- Bista, Dor Bahadur, People of Nepal
- Bista , Dor Bahadur, Sabai Jatko Fulbari
- Shrestha Siddhishwor Man & Shrestha Savitri, Social Studies, Akshalok Publication, 2071.
- Pokharel Nirmala, Nepal Parichaya , Makalu Publication House
- Gyanwali Ram Prasad , Bhundipuran Prakashan
- Kiran, Praviti and Nirasi Narayan Introduction to Nepal, Highland Publication P. Ltd.
- Shrestha, Hiranyalal Neapl Parichaya M.K Publichers and distributers
- Pokharel, Ishwor, Sociology-XII, Ekta Books and Distributors, Kathmandu
- Khatri, Prem Kumar et.al., Elementary Sociology and Anthropology XI, Bhundipuran Prakashan, Kathmandu
- Sharma, Kamal Raj, Introduction to Sociology and Anthropology inNepal-XI, Sunrise Prakashan Pvt. Ltd., Kathmandu
- Sitaula, Mohan Kumar, Introduction to Sociology and Anthropology-XI, Ekta Books and Distributors, Kathmandu

Course Contents

Course: Social Studies	**Hrs. theory 78**
Unit: 1 Introduction	**Hrs. theory 8**
Sub-unit: 1.1 The land of Nepal	
Objectives:	**Content:**
• Locate and discuss the state of Nepal in relation to the continents and countries of the world. • Describe the geographical divisions of Nepal.	Geographical locations, diversities, and unique characteristics of Nepal. Geographical divisions of Nepal: • Ecological • Climatic • Rivers

• Identify the administrative units of Nepal. • Compare the ecological, climactic, and regional diversities in Nepal. • Describe the natural resources of Nepal.	• Vegetation • Administrative(Provinanace, District , Municipalities and Rural Municipalities) Natural resources of Nepal- water, land, Forest, Mineral (general introduction). Patterns of land use in Nepal.
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion, textbook self-study.**
Unit: 2 Political History of Nepal	**Hrs. theory 15**
Sub-unit: 2.1 Ancient and medieval Nepal	**Hrs. theory 6**
Objectives:	**Content:**
• Discuss the historical events of the ancient period. • Explain the contributions of Manadeva, Amshuvarma and Narendradeva. • Explain why the period of Lichhavi rule is known as the golden period. • Summarize the brief history of Doya, Kasha, and Malla kingdoms. • Evaluate the contributions of Jayasthiti Malla,Yakbha Malla ,Pratap malla, Siddhinarshing Malla and Bhupatindra Malla. • Summarize the history of Gorkha and point out the reforms of Ram Shah	Ancient history of Nepal: • Origin of the word"Nepal" • Ancient dynasties: Gopal, Mahispal, Kirat, • Rise and contributions of Manadav, Amshuvarma, Narendradeva • Reforms of Licchavi period (Licchavi civilization). Medieval Nepal: • Doya Rajya or Karnatac • Kasha kingdom of Karnali region • Malla kingdom of Kathmandu valley • Rise and reforms of Jayasthiti Malla • Contributions of Siddhinarshing Malla, Bhupatindra Malla and Pratap Malla • Rise of Gorkha as an independent state, Ram Shah and his reforms.
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion, textbook self-study.**
Sub-unit: 2.2 Unification of Nepal	**Hrs. theory 5**
Objectives:	**Content:**
• Describe the geographical fragmentation of Nepal in the later medieval period. • Identify the causes of geographical fragmentation. • Explain the political, social, economic and geographical situation of Nepal before the enthronement of Prithvi Narayan Shah. • Analyse the policies adopted by Prithvi Narayan Shah and his successors during the time of unification.	• Petty states of Nepal (Baisi, Chaubisi), states in Kathmandu valley, three Sena states of eastern Nepal. • Political, social, economic and geographical conditions of Nepal before Prithvi Narayan Shah. • Unification of Nepal: Role of Prithvi Narayan Shah, Rajendra Laxmi and Bahadur Shah. • Political instability and the factors which influenced the rise of Jang Bahadur: • Conspiracies • Assassinations • Kot Massacre

• Identify the factors which influenced the rise of the Ranas.	• Bhandarkhal Parva • Alau Parva • Reasons of the downfall of Rana Regime
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion.**
Sub-unit 2.3: Peoples' movement and rise of democracy	**Hrs. theory 4**
Objectives	**Contents**
• Assess the improvement works of the first elected government of Nepal. • Examine the people's movement of 2046 B.S. and its impacts. • Examine the characteristics of the constitution of Nepal ,2047 B.S.and 2072 B.S • Discuss the impact of people's second movement on the social conditions of Nepal.	• The First elected government of Nepal 2015 B.S. • People's movement of 2046 B.S. • Comparative study of the characteristics of the constitution of 2047 and the Federal democratic Republic Nepal 2072 B.S. • Second people's movement 2062/2063 and its impacts.
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion.**
Unit: 3 Society & Culture	**Hrs. theory 26**
Sub-unit: 3.1 National Languages and their Literature	**Hrs. theory 4**
Objectives:	**Content:**
• Discuss the establishment of our national language. • Discuss the use of ethnic languages.	• History of development of our national language, other languages, and their literature: Nepali,Newari,Sanskrit,Maithili
Evaluation methods: written exam	**Teaching / Learning activities and resources: classroom instruction and discussion, textbook self-study.**
Sub-unit: 3.2 Arts ,religions and festivals of Nepal	**Hrs. theory 7**
• Compare the different cultural habits of Nepal. • Analyze the cultural heritage of Nepal. • Discuss the development of arts in Nepal. • Explain the history of religious harmony in Nepal.	Cultural heritages of Himalayan, Hilly and Terai regions: • Food habits • Dress and ornaments • Festivals and temples • Music, songs and dances • Occupations Art in Nepal: • Paintings, sculpture and architecture in ancient, medieval and modern times. Some common features of religions Major Religions in Nepal: • Hinduism • Buddhism

	• Muslim • Kirat • Christian Major festivals of Nepal Sociological signification of Dashain ,Tihar, Lhosar and Chhat
Sub - unit 3.3 Social stratification	**Hrs. theory 5**
Objectives	**Content**
Explain meaning and characteristics of social stratification. Describe dimension of social stratification.	• Meaning • Characteristics • Dimension of Social startification Social class Caste/ ethinicity Economic Gender
Sub -unit 3.4 Social and cutural change	**Hrs. Theory 5**
Objectives:	**Content:**
Explain meaning, and characteristics of social and cultural change. Describe the factors of social and culutural change. Explain the role of communication and media in social and cultural change	Meaning Characteristics Factors of social and cultural change • Economy • Technology • Education • Demography Role of Communication and media in social and cultural change
Sub-unit3.5 Social problems and solutions	**Hrs : Theory 5**
objectives	**Content**
• Identify the major social problems of Nepal. • explain the causes of social problem • Describe the role played by natioal and international organisation in solving social problems	Social problems: Poverty Gender issues Unemployment Drug addictions HIV/AIDS Prostitution Child labor Trafficking • others Causes of social problems Role played by national and international organisation in solving social problems
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion.**
Unit: 4 People and Economy of Nepal	**Hrs. theory 15**
Sub unit 4.1 People of Nepal	Hrs 5
Objectives:	**Contents**
Analyze the population growth of Nepal:	• Population size and distribution

Describe the contributing factors of population growth and effects on society.	• Population by age, sex, caste, language, religion, ecological composition. • Fertility, Mortility, migration of the inhabitance of Mountain , Hill and Terai
Sub-unit: 4.2 Economy of Nepal and National Integration	**Hrs. theory 8**
Objectives:	**Content:**
Explain fundamental aspect of Nepalese Economic Analyse the affecting factors of Nepalese economic development. Explain the various features of Nepal's economic system.	Fundamental aspect of Nepalese Economy • Agriculture • Natural resources(Forest, land , water, minerals) • Remitance • Tourism • Foreign aid and loan • Human resources Affecting factors for Nepalese economic development : • Poverty • Inequality, • Population growth, • Unemployment, • Regional disparities • Land tenures. Features of the Nepalese economic system: • Agriculture and land reform system • Cottage and large scale industries • Internal and external trade • Tourism • Cooperation • Planned economy • Mixed economy (capitalism and socialism)
Evaluation methods: written exam	**Teaching / Learning activities and resources: classroom instruction and discussion, textbook self-study.**
Sub-unit: 4.3 Integration of Nepal	**Hrs. theory 2**
Objectives:	**Content:**
Explain meaning of integration of Nepal	Meaning of intergration • National integration • Cultural integration • Normative intergration • Social integration
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion.**
Unit: 5 Politics and Government	**Hrs. theory 14**
Sub-unit: 5.1 Democratic constitution	**Hrs. theory 2**
Objectives:	**Content:**
• Distinguish between a democratic and non-democratic form of government.	• Meaning and definition of democracy; characteristics of democratic government; meaning of non-democratic government.

Evaluation methods: written exam	**Teaching / Learning activities and resources: classroom instruction and discussion, textbook self-study.**
Sub-unit: 5.2 Federalism	**Hrs. theory 7**
Objectives:	**Content:**
Explain the structure of the state and distribution of power Explain the civic duties and responsibilities for the sucessful implementation of the constitution of Nepal. .	Concept of regional development and federalism in Nepal Federal state in nepal Structure of the state Federal Provincial Local Distribution of state power • Federal • Province • Local Legislative: Federal Parliament (House of Representatives and National Assembly) Composition, power and functions: Executive: (Federal Executive and Council of Ministers) Composition, power and functions Judiciary: (courts – Supreme Court, High courts, district courts) Composition, power and functions of judiciary. President and Vice President : Functions, duties and authorities. Fundamental rights and duties of citizen people.
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion.**
Sub Unit :5.3 Provincial Legislature and Provincial Executive	**Hrs. theory 5**
Objectives:	**Content:**
• Explain the structure of local executive. • Explain the Interrrelationship between the Federal provinces and Local level	Federal provinces and local level. • Village Assembly, • Municipal Assembly • Village executive and municipality • District Assembly and District coordination committee • Interrelationship between the Federal provinces and local level

Physics

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

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 emphasize both quantitative and qualitative aspects of physics, involving mathematical models and equations. The application of physics to social and environmental situations is well illustrated. The practical components of this course are designed to supplement learning through the application of learned theories. The students will handle simple apparatus to do simple measurements, demonstrate simple electrical circuits and apply their knowledge of physics in the real life.

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

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

Recommended text:

- Khatry M.K et.al, Principles of physics.(Grade XI & XII), Ayam Publication and distributer pvt.Ltd
- Shrestha, U.P, Physics Practical Guide
- Shrestha V.K, Numerical examples in physics, Vol. 1&2, Ratnapustak Pustak Bhandar, Nepal
- Shrestha V.K., Numerical Physics.

Reference Texts:

- Nelkon and parker, advanced level physics (5^{th} ed)
- Verma, H.C, Concepts of physics i &ii

Course Contents

Course: Physics for Forestry	**Hrs. Theory 117** **Hrs. lab 78**
Unit 1: Mechanics	**Hrs. theory 25**
1.1 units and measurement	**Hrs. theory 3**
Objectives	**Content**
Measure precisely mass, length, time, volume, density, pressure and specific gravity. Define fundamental and derived units Explain MKS, CGS and SI system of units	The use of meter scale, spring, balance, and physical balance, stopwatch for measurement of length, mass and time

Convert one system of units into another system of units Express derived units in terms of fundamental units. Uses of dimension	Basic table of measurement for units of mass, length and time Various systems of units and their conversion Express derived units in terms of fundamental units Dimensional formula for various physical quantities Explain use of dimensional equation to test the correctness of physical equations to derive physical relation to convert one system of unit into another system of unit to find dimensions of a constant in an equation.
Evaluation methods: written and viva exams, performance observation.	Teaching/learning activities and resources: classroom instruction and demonstration return demonstration models, solving related problems.
1.2 Scalar and vectors	**Hrs: theory 2**
Objectives	**Content**
Differentiate between vectors and scalars. Identify whether a physical quantity is scalar of vector. Resolve vectors into rectangular components. Point out the resultant to two or more vectors by graphical method. Write the values of scalar product and vector product, for selected problems.	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
Evaluation methods: written and viva exams, performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
1.3 Kinematics	**Hrs: theory 2**
Objectives	**Content**
Define displacement, velocity, instantaneous velocity, average velocity, uniform velocity and acceleration retardation Differentiate between distance and displacement speed and velocity. Write down the relation of kinematics equation of motion (linear and gravitational). Calculate the time of flight, maximum height and horizontal tangs of projectile. Solve simple problems related to the projectile.	Displacement, velocity, instantaneous velocity, average and uniform velocity and acceleration (retardation) Distance and displacement, speed and velocity The concept of projectile motion. simple numerical problems
Evaluation methods: written and viva exams, performance observation	Teaching/learning activities and resources: classroom instruction and demonstration, return demonstration, models, solving related problems
1.4 Force	**Hrs. theory 4**
Objectives	**Content**
State Newton's laws of motion. Give the concept of inertia of rest, motion and direction. Define force in terms of rate of change of momentum and give their directions Derive F= ma and use it to solve simple problems.	Linear momentum and significance of Newton's laws of motion in various concepts. Meaning of inertia of rest and inertia of motion. Applications of inertia and impulse. Angular displacement, velocity and acceleration. Derivation of the relation $v=\omega r$

State and prove principle of conservation of linear momentum with examples. Define angular displacement, angular velocity and angular acceleration. Distinguish between angular velocity and linear velocity and obtain the relation between them. Define circular motion, centripetal force and centrifugal force. Differentiate between elastic and inelastic collision. Define friction, laws of limiting friction and coefficient of friction	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
Evaluation methods: written and viva exams, performance observation.	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
1.5 Work energy and power	**Hrs theory 2**
Objectives	**Content**
Fined work energy and power and give their units in various systems. Define KE and PE also give their magnitude. State and verify the principle of conservation of energy.	The distinctions between the common uses of the term work, energy i.e. change of KE into PE giving example of falling body. Simple numerical problems
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
1.6 Gravity and Gravitation	**Hrs theory 4**
Objectives	**Content**
State Newton's law of gravitation. Deduce unit and dimension of G. Define acceleration due to gravity and variation of g due to height Differentiate between mass and weight Differentiate between center of gravity and center of mass.	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. Simple numerical problems
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
1.7 Properties of Matters	**Hrs theory 4**
Objectives	Content
Define elasticity State hook's law of elasticity Define stress,strain and Young's modulus of elasticity Define viscosity State Newton's Formula of viscocity Define Coefficient of viscocity Define and explain surface tension Explain adhesive and cohesive force	Definition of elasticity Statement of hook's law of elasticity Definition stress,strain and Young's modulus of elasticity Definition of viscosity Statement of Newton's Formula of viscocity Definition of Coefficient of viscocity Define and explain surface tension Definition of adhesive and cohesive force

Explain phenomenon of capillarity (no derivation of formula Solve related numerical problems	Explain phenomenon of capillarity (no derivation of formula Solve related numerical problems
1.8 Hydrostatics	**Hrs theory 4**
Objectives	**Content**
Explain that liquid pressure is proportional to the depth of the liquid and independent of the shape of the vessel. Define density, and specific gravity of solids and liquids. Explain Pascal's law and Archimedes's principle. State the principle of flotation and condition of equilibrium of floating bodies.	Fluid pressure and determination of the formula $P=\rho gh$. Pascal's law. Density and specific gravity. Difference between density and specific gravity. Archimedes's principle and its uses. The Principle of flotation and condition of equilibrium for floating bodies. Atmospheric pressure with examples.
Evaluation methods written and viva exams, performance observation.	Teaching/learning activities and resources: classroom instruction and demonstration return demonstration models, solving related problems.
Unit 2: Heat	**Hrs theory 13**
2.1 Thermometry	**Hrs theory 3**
Objectives	**Content**
Define heat and temperature and distinguish between them. Describe the construction, calibration and sensitivity of a liquid thermometer. Determine the lower and upper fixed points of the thermometer. Define different temperature scales (Celsius, Fahrenheit and Kelvin) Convert one temperature scale into another using the temperature conversion formula. Solve numerical problems.	Concept of heat temperature. Explain the construction and working of liquid thermometers and determine two fixed points. Demonstrate various types of thermometers and explain their uses. Derivation of the formula: C/5 = (F-32)/9=(K-273)/5 Simple numerical problems
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
2.2 Expansion	**Hrs theory 3**
Objectives	**Content**
Describe linear, superficial and cubical expansion of solids and their expansivity. State the relation between linear, superficial and cubical expansivity of solids (not derivation). Define real and apparent expansion of liquid. Explain the change in density of a substance with the variation of temperature. Anomalous properties of water	Linear, superficial and cubical expansion of solids. The relations $1_2=1_1[1+\alpha(\theta_2-\theta_1)]$, $A2=A_1[1+\beta(\theta_2-\theta_1)]$, $V2=V_1[1+\gamma(\theta_2-\theta_1)]$. Concept of $\gamma=3\alpha$ and $\beta=2\alpha$. 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.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
2.3 Heat capacity	**Hrs theory 4**

Objectives	Contents
Define heat capacity, specific heat capacity. Explain the quantity of heat content of a body $Q=ms\theta$. Explain the energy required to cause a phase change at constant temperature. Explain latent heat of fusion and latent heat of vaporization. Define freezing, melting and boiling point of a substance. Discuss the effect of pressure on melting and boiling point of the substance.	Heat capacity, specific heat capacity. Determination of specific heat capacity of solid by the method of mixture. Melting point, boiling point and freezing point of a substance. The effect of pressure on melting and boiling point of substance. Simple numerical problems.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
2.4: Transfer of Heat	**Hrs theory 3**
Objectives	**Contents**
Differentiate between conduction, convection and radiation. Define thermal conductivity with its units and dimension. Distinguish between good and bad conductors of heat. Define black body. State the Stefan Boltzmann law and give an example of its application.	The transfer of heat by conduction, convection and radiation Thermal conductivity giving their dimension and units Laws of black body radiation Solve related numerical problems
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
Unit: 3 Light	**Hrs theory 15**
3.1 Reflection of light	**Hrs theory 5**
Objectives	**Content**
Explain the laws of reflection of light. Deviation of light by plane mirrors Distinguish between real and virtual image. Show that in plane mirror object distance = image distance. . Show that r = 2f for spherical mirrors. Draw ray diagrams to solve problems involving spherical mirrors. Derive the formula 1/u+1/v= 1/f	The Phenomenon of reflection and hence state the laws of reflection of light Object distance is just equal to image distance in a plane mirror i. e. u=v Real and virtual image. Define the terms pole, center of curvature, radius of curvature, principal focus, principal axis, focal length Derive the relation r=2f, 1/u+1/v=1/f and m = I/O= v/u for 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

Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
3.2: Refraction	**Hrs theory 10**
Objectives	**Contents**
State and explain the laws of refraction of light. Derive the expression for apparent depth and lateral shift in a glass slab. Define critical angle and total internal reflection. Explain the phenomena of total internal reflection. Explain the passage of light rays through a prism. Derive the formula $i+e=A+\delta$ and $A=r_1+r_2$. Define minimum deviation and derive the formula $\mu=\sin(A+\delta_m)/2/\sin(A/2)$. Draw a ray diagram to locate positions of image in thin lenses (concave and convex). Derive lens formula and lens maker's formula. Defect of vision, telescope and microscope, interference, diffraction and polarization (introduction only)	Phenomenon of refraction. Verify the laws of refraction of light and define refractive index of different media. 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 apparemt depth. The relation $d=t\,(1-1/\mu)$ and lateral shift $P=t[\sin(i-r)]/\cos r$. Derivation of the formula $\mu=1/\sin C$. Critical angle and conditions for total internal reflection. Examples of total internal reflection phenomena like mirage, light pipe. The formula $A+\delta_m=i+e$ and $\mu=\sin(A+\delta_m/2/\sin A/2$. Uses of different types lens and diverging aspect of convex lens and diverging aspect of concave lens. Lens formula and lens maker's formula Defect of vision, telescope and microscope, interference, diffraction and polarization (introduction only) Simple numerical problem
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
Unit 4: Electrostatics	**Hrs theory 7**
Objectives	**Contents**
State and explain coulomb's law. Explain the properties of lines of force Define electric field and electric flux. Calculate electric field intensity due to a point charge Define electric potential difference, potential energy and electron volt. Derive electric field potential at any point in an electric field Explain the equipotent surface Define capacitance of a capacitor and its type Derive E=V/d, for parallel plates capacitor	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. Derivation of electric field intensity due to a point charge Potential and potential energy Derive electric field potential at any point in an electric field Capacitor and capacitance and its units. Derive E=V/d, for parallel plates capacitor
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems

Unit 5: Magnetism	**Hrs theory 10**
Objectives	**Contents**
Explain magnetic field strength, lines of force, magnetic field intensity and permeability State coulomb's law for magnetism Describe the properties of a magnet Calculate magnetic field intensity due to a bar magnet at any pointy on the equatorial and axial line of a bar magnet. Trace the lines of force and describe their properties. Define natural point. Describe the dip, declination and horizontal components of earth's magnetic field. Define and give the properties of dia, para and ferromagnetic materials	Like pole repel and unlike pole attract each other Various types of magnets and their positions of poles Coulomb's law for magnetism 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 no uniform magnetic field Dip, declination, horizontal and vertical components of earth's magnetic field. Properties of dia, para and ferromagnetic materials
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
Unit-6: Wave and Sound	**Hrs 6**
Objectives	**Contents**
Define damped vibration, force vibration and resonance Define mechanical, electromagnetic wave, longitudinal waves, transverse wave, progressive wave and stationary wave Derive progressive wave equation and stationary wave equation Discuss velocity of sound in medium and gas by Newton's formula and Laplace formula (no derivation) Effects of temperature, pressure and humidity on velocity of sound Sound Wave: musical sound and noise Characteristics of sound wave (intensity, pitch and timber), noise pollution: source, health hazards and control	Definition of damped vibration, force vibration and resonance Definition of mechanical, electromagnetic wave, longitudinal waves, transverse wave, progressive wave and stationary wave Derivation of progressive wave equation and stationary wave equation Discussion of velocity of sound in medium and gas by Newton's formula and Laplace formula (no derivation) Effects of temperature, pressure and humidity on velocity of sound Sound Wave: musical sound and noise Characteristics of sound wave (intensity, pitch and timber), noise pollution: source, health hazards and control
Unit 7: Current electricity	**Hrs theory 23**
7.1: Electric current	**Hrs theory 7**
Objectives	**Contents**
Discuss current as the rate of flow of charge. State and verify Ohm's law. Define resistance and resistity List the factors that influence resistance of a conductor. Distinguish between ohmic and non-Ohmic conductors. Find the equivalent resistance from the series and parallel combination of resistors. Perform the conversion of galvanometer into voltmeter and ammeter	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.

	Conversion of galvanometer into voltmeter and ammeter. Simple numerical problems.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
7.2: Resistance and heat	**Hrs theory 6**
Objectives	**Contents**
State and explain joule's laws of heating. Distinguish between potential difference and *emf*. Relate *emf*, terminal potential and internal resistance.	Joule's laws of heating and derivation of the equation $H=i^2Rt/J$. Heat production in resistance wire due to passage of current. Electric power in terms of energy dissipated in a time in the resistance wire. Electric power, watt, kilowatt, kilowatt-hour and horsepower. Meaning of *emf* and internal resistance *ofa* cell Establish the relation ,$E=V+Ir$ Simple numerical problems
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
7.3: Magnetic effect of current, electromagnetism and alternative current	**Hrs theory 10**
Objectives	**Contents**
Explain or Oersted's discovery, direction of current and field Dependence of force on physical factors Find force on moving charge Define electromagnetic induction State Faraday's laws of electromagnetic induction State Lenz's law Explain the principle and working of a transformers Describe step up and step down transformer Describe alternating current (AC) and its interpretation. Relate rms and mean value of current and voltage with its peak value.	Explanation of Oersted's discovery, direction of current and field Dependence of force on physical factors Find force on moving charge Definition of electromagnetic induction Statement of Faraday's laws of electromagnetic induction Statement of Lenz's law Explain the principle and working of a transformers Describe step up and step down transformer Describe alternating current (AC) and its interpretation. Expression rms and mean value of current and voltage with its peak value.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
Unit 8: Modern physics	**Hrs theory 18**
8.1: Electrons	**Hrs theory 3**
Objectives	**Contents**
Explain the particles nature of electricity. Discuss the nature, production and properties of cathode rays Review the motion of electrons in electric and magnetic fields.	Particles nature of electricity Production and properties of cathode rays Moving electrons in electric and magnetic fields. Specific charge of an electron.

Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
8.2: Photons	**Hrs theory 3**
Objectives	**Contents**
Define the terms photoelectric effect, photon, wave function, threshold frequency and stopping potential. Explain photoelectric effect on the basis of the quantum theory of radiation. Drive a photoelectric equation. Give the application of photoelectric effect	Photoelectric effect, quantum theory of radiation. Einstein's photoelectric equation $h\nu=\varphi+1/2mv^2$ and interpretation. Simple problems using photoelectric equations.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
8.3 X-ray	**Hrs theory 3**
Objectives	**Contents**
Draw well leveled diagram of modern x-ray tube. Explain the production mechanism of x-rays. Discuss the properties of x-rays.	Production, nature and use of x-rays. Property of x-rays. Various uses of x-rays.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
8.4: Radioactivity	**Hrs theory 4**
Objectives	**Contents**
Explain the difference between natural and artificial radioactivity List the main properties of α, β and γ radiation. Write down the equation for the laws of radioactivity Write down the formula that shows that the relationship n between half-life and decay are constant. Graph the decay of radioactivity with time. Explain the principle involved in radio carbon dating.	Radioactivity. Properties of α, β and γ radiations. Laws of radioactive disintegration. The constant relationship between half-life and decay. Medical uses of radiation and artificial radioactive nuclei. $N=N_o e^{-\lambda t}$, Simple numerical problems.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
8.5: Properties of nucleus	**Hrs theory 5**
Objectives	**Contents**
Describe the constituents of a nucleus. Classify different types of nuclei. Define unified atomic mass units (amu), mass defect, binding energy and binding energy per nucleons, Calculate the mass defect and binding energy of a nucleus	The constitutions of nuclei. Isotopes and mass numbers of different elements isotope instability $E=mc^2$ (only qualitatively) Fission, fusion, and energy released from these nuclear reactions Radiation hazard and safety.

Calculate energy equivalence of mass in joules, eVand MeV Explain Einstein's mass-energy relationship theory. Define fission and fusion and calculate the energy released Discuss health hazards and safety related to radiation.	Calculation of mass, defect and loss of mass due to radioactive disintegration numerically.

Physics Practical	
Course: Physics Practicals	**Hrs lab 78**
Objectives	**Contents/Hrs**
Practical-1: Determine the volume of a hollow cylinder and a solid cylinder using vernier calipers.	Volume of hollow and cylinder using vernier calipers (**5hrs**)
Practical-2: Determine the volume of a steel ball using a screw gauge	Volume of steel ball using screw gauge (**5hrs**)
Practical-3: Determine the thickness of a glass plate using a Sphero meter	Area of glass plate (**3hrs)**
Practical-4: Verify the laws of reflection of light and find the relationship between object distance and image distance.	Laws of reflection of light Relationship between object distance and image distance (**5hrs)**
Practical-5: Determine the specific gravity of solids dissolved in water.	Specific gravity of solids dissolved in water **(5hrs)**
Practical-6: Determine the specific gravity and density of substances lighter than water.	Specific gravity and density of substances lighter than water (**5hrs**)
Practical-7: Determine the specific gravity of substances lighter than water	Specific gravity of substances lighter than water **(5hrs)**
Practical-8: Verify laws of refracting and find the refractive index	Laws of refracting Refractive index (**5hrs**)
Practical-9: Find the focal length of a convex lens by the double pin method.	Focal length of a convex lens **(5hrs)**
Practical-10: Verify the laws of moments of forces and find the weight of a given body.	Laws of moments of forces Weight of a given body (**5hrs**)
Practical-11: Determine the latent heat of fusion of ice.	Latent heat of fusion of ice (**3hrs)**
Practical-12: Determine the magnetic moment and pole- strength of a bar magnet by locating the neutral points, keeping N-pole pointing south and N-pole pointing north.	Magnetic moment and pole-strength of a bar magnet by locating the neutral points **(5hrs)**
Practical-13: Verity Ohm's law by using an ammeter and voltmeter.	Ohm's law (**5hrs)**
Practical-14: Demonstrate the variation of lateral displacement with an angle of incidence in a rectangular slab.	Lateral displacement with an angle of incidence in a rectangular slab (**5hrs)**
Practical-15: Determine the refractive index of a prism using the 1-D curve method.	Refractive index of prism (**5hrs)**
Practical-16: Verify Archimedes' principle and find the specific gravity and density of	Application of theory from preceding units. **(5hrs)**

solids insoluble in water. Determine the resistance of given writes by meter-bridge.	
Evaluation methods: written and viva exams, performance observation.	Teaching /Learning activities and resources: Class room instruction, demonstration, Observation, illustration, diagrams, visuals, textbooks, and reference books.

Chemistry

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

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 every day life and to the application of chemistry in forestry science. An additional function of the course is to stimulate interest in the application of chemistry and to prepare the student for further study in this field. Chemistry practical acquaints the student with use of related laboratory equipment and provides practical application of learned theory, which is relevant to Forestry.

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

1. explain the basic chemical changes involved in chemistry
2. test the soil to increase the fertility with proper treatment
3. apply the knowledge of chemistry for the production of improved quality & hygienic food
4. utilize chemical principles in laboratory testing
5. explain the photo-chemical responses that occur within the body during illness
6. apply the theoretical & practical knowledge of phyto-chemistry, which is directly involved in human life

Recommended Texts

1. Mitra, Ladli Mohan, A Textbook of Inorganic Chemistry.Ghosh & Co. Current edition.
2. Tuli, G.D. et al., Intermediate Organic Chemistry. S. Chand &Co. Current edition.
3. Jauhar, S.P., Modern ABC's of Chemistry (Vol I&II). Modern Publishers. Current edition

RefereceTexts

1. Jha, J.S., & Gugliani, S.K., A Textbook of Chemistry. Seirya Publication. Current edition.
2. Shamim, A.S., Intermediate Referesher Couse in Chemistry. Vipin Prakasar. Current edition.
3. Sthapit, M. & Pradhanaga, R.R., Fundamentals of Chemistry (Vol I & II). Taleju Prakashar.Current edition.
4. R.D madan Modern Inorganic Chemistry. -S. Chanda & Company.
5. Medicinal Plants in Nepal; RDRL Publication, NG Nepal.
6. Methods in Plant Biochimistry. Vol 6 Acamdemics Press, New York.
7. Leela Dahal, A Study on Pesticide Pollution in Nepal -IUCN, NCS Implementation project.
8. Basic Food Chemistry- Lee, Avi Publication
9. William Honag Land Meyer Food Chemistry -CBS Publishers & Distributors, 1st Indian edition-1987.
10. Soil Science.
11. N.K Vishnoi Advanced Practical Organic Chemistry, Second revised edition Vikas Publishing Pvt-Ltd.

Course Contents

Course: Chemistry	**Hrs. theory 117** **Hrs. lab 78**
Unit 1: Physical Chemistry	**Hrs. theory 51**
1.1: Elements, compounds and chemical change	**Hrs. theory 3**
Objectives	Contents
1. List the symbols of elements. 2. Identify monovalent, divalent, trivalent elements and radicals. 3. List the information conveyed by symbol and formula 4. Identify physical and chemical change. 5. Identify the suitable process for separating constituents of a mixture. Q. What are the differences among H^+, H^-, H_2, $2H_2$, and 2H? Q. Write the molecular formula of potassium Ferro cyanide sodium peroxide.	1. Symbols for the atom, molecule, and compound radical and variable valency 2. Writing, a chemical formula 3. Significance of symbols and formulas 4. Molecular and empirical formulas 5. Difference between chemical compound from mechanical mixture 6. Pure and impure substances 7. The processes of separating the constituents of a mixture
Evaluation methods: Written exam, oral and written assignments, performance observation in lab.	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration-Reaction of sodium on water.
1.2: Chemical equations	**Hrs. theory 3**
Objectives	Contents
1. Construct a graphical representation of the relationship between amount of reactant and product with time. 2. Describe ways to make the equation more informative. 3. Demonstrate how to balance a chemical equation. 4. Explain any seven types of reaction with two examples of each. 5. Tell whether mass is conserved or not in the examples above. Q. What is the quantitative significance of a chemical equation?	1. Chemical equation, reactant and product 2. Significance and limitations of chemical equations 3. Ways of making chemical equations more informative 4. Conditions by which reactions take place-contact, heat, light, pressure, electricity, bio-chemical agents, catalyst, sound 5. Type of chemical reactions (seven-types) with examples 6. Balancing a chemical equation by A. trial and error method B. Partial equation method
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities or resources :** Theoretical explanation, Classroom instruction exercises, Demonstration-Reaction of a piece of zinc with excess acid
1.3: Periodic table	**Hrs. theory 5**
Objectives	Contents
1. Identify the location of s, p, d, and f block elements. 2. Define atomic radii, electro-negativity IP, EA.	1. Modern periodic classification of elements. 2. Location of s, p, d, f-block elements 3. Periodicity in properties by:

3. Identify alkali and alkaline earth metals, halogens, noble gases, transition metal, and radioactive elements and indicate their location. Q. which one, Cl or Br, is more electronegative and why?	Q. Atomic radii (ii) Electro negativity (iii) Ionization potential (iv) Electron affinity (v) Metallic character
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration-Reaction of a piece of zinc with excess acid. Chart display: Long and short form of periodic table.
1.4: States of matter-Gaseous state	**Hrs. theory 4**
Objectives	**Contents**
1. Compare the volume of gas at different conditions (pressure and temperature) 2. Compare the rates of diffusion of different gases. Q. Which one, CO_2 or SO_2, diffuses faster and why?	1. Effect of pressure and temperature on volume of gas 2. Boyle's law, Charles'slam combined gas lawa, daltion law of partial pressure 3. Simple derivation of ideal gas equation (PV=nRT) 4. Diffusion of gas 5. NTP or STP 6. Kinetic theory of gases 7. Related simple problems.
Evaluation methods: written exam, oral and written assignments, performance observation in lab	Teaching/Learning activities and resources: classroom instruction, theoretical explanation, problem solving, and demonstration-Reaction of a piece of zinc with excess acid.
1.5: States of matter-Liquid State	**Hrs. theory 3**
Objectives	Contents
1. Define solubility and solve problems based on solubility 2. Define viscosity and surface tension 3. Describe effect of temperature on viscosity and surface tension Q. Why water can flow more easily than honey?	1. Unsaturated, saturated and supersaturated solution 2. Solubility, Solubility charge and related numerical problems 3. Viscosity and surface tension 4. Effect of temperature on viscosity and surface tension
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, demonstration-compare
1.6: States of matter-Solid State	**Hrs. theory 3**
Objectives	Contents
1. Define amorphous and crystalline solids and give examples. 2. List the examples of crystalline, deliquescent, hygroscopic, efflorescent,	1. The deference between amorphous and crystalline solids

Isomorphism, liquid crystal and substances.	2. Water of crystallization, deliquescent, hygroscopic, efflorescent, Isomorphism 3. structure of NaCl crystal
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, demonstrateion-FeCl3 exposed to air, blue vitriol heated.
1.7: Atomic Structure - State	**Hrs. theory 3**
Objectives	Contents
1. Define electron, proton & neutron with their charge and mass. 2. List the postulates of Bohr's atomic model. 3. Design electronic configuration of elements (up to Z=30) 4. Define radioactive decay with common examples. 5. Explain the use of radiation in the field of forestry. 6. Describe the pollution due to radioactivity.	1. Charge and mass of fundamental particles of atoms 2. Rutherfords and Bohr's atomic model 3. Shell, sub-shell and orbital (s, p, d, f) 4. How electrons are arrangement of electrons in orbits (Aufbau principle) 5. Atomic number, mass number, atomic weight and gram atomic weight 6. Isotopes and isobars.
Evaluation methods: written exam, oral and in lab and Written assignments, performance observation	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration.
1.8: Electronic theory of valency	**Hrs. theory 4**
Objectives	Contents
1. Define valence electron, duplet, octet and noble gas electronic configuration. 2. Describe the Lewis structure of different molecules. 3. List the properties of electrovalent, covalent and co-ordinate covalent bond. Q. Why is ammonia readily soluble in water?	1. Valence electron, duplet, octet and Noble gas electronic configuration 2. The mode of formation and properties of compounds (i) Electrovalent (ii) Covalent (iii) Co-ordinate covalent 3. Polar and non-polar covalent bond and compound 4. Types and effect of Hydrogen bond
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration.
1.9: Oxidation and Reduction	**Hrs theory 3**
Objectives	Contents
1. Identify oxidation half, reduction half, oxidant and reductant.	1. Classical and electronic concept of oxidation and reduction. 2. Oxidant and reductant and oxidation number 3. Importance of oxidant, reductant in Biological process, sterilization and

	disinfection, bleaching and spot removal. 4. Examples of redox reaction 5. Balancing a redox reaction by i) oxidation number method ii) Ion-electron method
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration.
1.10: Electrochemistry	**Hrs. theory 5**
Objectives	Contents
1. Differentiate between (i) Electrolytes and non-electrolytes (ii) Strong electrolytes and weak electrolytes (iii) Ions and atoms. 2. Describe the variation of degree of ionization 3. State and explain common ion effects 4. State briefly Faraday's laws of electrolysis 5. Compute the pH of neutral water above and below 25^{o}C 6. Define buffer solution (acidic and basic) 7. Solve numerical problems related with pH acidic or basic solutions Q. Explain why NaCl becomes ionized in water while glucose does not	1. Electrolytes, Non-electrolytes, strong and weak electrolytes 2. Arrhenius theory of ionization 3. Degree of ionization, Faraday's laws of electrolysis 4. Electrolysis of water 5. Ionic product of water, pH. pOH 6. Buffer solution and mechanism of buffer action 7. Importance of pH and buffer in human body
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration.
1.11: Acid, base and salt	**Hrs. theory 5**
Objectives	Contents
1. Compare general properties of acid, base and salts. 2. Define weak and strong acid and base. 3. Define neutralization. 4. List the deferent types of salts. 5. Identify the nature of salt solution. 6. Identify the requirements for the substance to be antacid and ant abase.	1. Characteristics of acid and base. 2. How acid neutralizes carbonate and neutralization of carbonate or bicarbonate by acid 3. Theories of acids and base i) Arrlenilus theory ii) Bronsted-lowery theory iii) Leuis's Theory 4. Various types of salts 5. Nature of aqueous solution of salts. 6. Antacids and antabases and their medical uses 7. Examples of acid and base in plants and their roles

Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration-reaction between: carbonate and acid, acid and base
1.12: Solutions-True solution	**Hrs. theory 3**
Objectives	Contents
1. Define osmosis, reverse osmosis, osmotic pressure, and isotonic, hypotonic and hypertonic solutions. 2. Explain the importance of osmosis ephemeron.	1. Dilute and concentrated solution 2. Diffusion of solute in solution, osmosis, osmotic pressure isotonic, hypotonic and hypertonic solution 3. Biological importance of osmosis
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
1.13: Mole concept and chemical arithmetic	**Hrs. theory 3**
Objectives	Contents
1. Relate number of mole with gram molecular weight, number of particles and volume occupied (for gas). 2. Identify limiting and excess reagent. 3. Estimate the amount of reactant required and product formed in any reaction. Q. What volume of oxygen at NTP is required to oxidize 10-gram glucose and volume of CO_2 will be formed?	1. Mole and Avogadros' number. 2. Determination of percentage composition. 3. Numerical related to the following relationships based upon chemical equation - Mass-Mass relationship Mass-volume relationship Volume-volume relationship 4. Calculation based on limiting reagent.
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
1.14: Volumetric analysis	**Hrs. theory 4**
Objectives	Contents
1. Define different units of concentration and show their relation. 2. Prepare standard solution of desired concentration and solve problems on dilution. 3. Solve different numerical regarding acidimetry and alkalimery.	1. Equivalent and gram equivalent weight of element, acid, base, and salt 2. Titration, acidimetry, alkalimetry, end point, indictor, primary standard substance 3. Ways of expressing concentration of solution in terms of i) Normality ii) Molarity iii) Molality and %. 4. Normality equations 5. Calculations to prepare different concentrations of solution
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction,

	theoretical explanation, problem solving, and demonstration
Unit 2: Organic Chemistry	**Hrs theory 39**
2.1: An introduction to organic Chemistry	**Hrs. theory 5**
Objectives	Contents
1. List the difference between organic and inorganic compounds. 2. List the importance of organic compounds in medicines and drugs with common examples. 3. Role of forest product in medicine. 4. Scope of organic chemistry for forestry	1. Origin of organic chemistry-Vital force theory and modern theory 2. Difference between organic and inorganic compound 3. Sources of organic compound 4. Importance of organic compound in medical and forest (i) Antipyretics (ii) Analgesics (iii) Antibiotic (iv) Antimalarials (v) Tranquilizers (vi) Germicides (vii) Antiseptic found in plants.
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
2.2: Nomenclature of organic compounds	**Hrs. theory 5**
Objectives	Contents
1. Tell the reasons for large number of organic compounds. 2. Classify the organic compounds into various types. 3. Describe fictional group with different examples. 4. Describe characteristics of homologue. 5. Use the IUPAC system for nomenclature. Q. Write down the name and structure of the following functional groups: $CONH_2$, COOH	1. Reason for large number of organic compounds- (i) Tetrvalency (ii) Catenation property (iii) Isomerism 2. Various types of organic compounds with their examples 3. Functional group and its various types 4. Homologous series with examples 5. Prefix, primary suffix, secondary suffix, and principal functional group 6. Naming aliphatic and aromatic compounds with IUPAC systems. 7. Detection of foreign elements N,S and X
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
2.3: Isomerism	**Hrs theory 3**
Objectives	Contents
1. Describe the different kinds of structural…. 2. Explain choral optically active substance.	1. Definition of isomerism. 2. Structural isomerism of the types- (i) Positional (ii) Functional (iii) Metamerism

Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
2.4: Organic reaction	**Hrs. theory4**
Objectives	Contents
1. Identify the nature of reaction. 2. Create concept about writing mechanism of simple reactions. Q. What are attacking reagents? Give two examples of each.	1. Carbocation and carbanion. 2. Inductive effect (+1 and -1 effect) 3. Homolysis and heterolysis bond fission. 4. Electrophones and Nucleophiles. 5. Resonance. 6. The types of organic reactions-Electrophonic and nucleophilic substitution, addition, elimination.
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
2.5: Hydrocarbons	**Hrs Theory 6**
Lesson A: Alkane	Hrs 2
Objectives	Contents
1. Describe the isomerism in alkane. 2. Describe the substitution in alkenes. 3. Describe the knocking of fuel.	1. The physical properties of alkanes (only methane) 2. Chemical properties-halogenation combustion, phyrolysis 3. Uses in everyday life
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
Lesson B: Alkene	Hrs theory 2
Objectives	Contents
1. Describe the addition reaction. 2. Describe the test of alkene.	1. Laboratory preparation of ethane from ethanol 2. The physical properties. 3. The chemical properties-Combustion, halogenation, with Br_2 solution, with halogen acid (Test of double bond), with Baeyer's reagent, polymerization, ozonolysis 4. Markovnikov's rule
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
Lesson C: Alkyne	Hrs. theory 2 Hrs Lab
Objectives	Contents
1. Describe the addition reaction in alkyne. 2. Explain the acidic nature of alkyne.	1. Laboratory preparation of ethyne from calcium carbide 2. Physical properties of acetylene

3. Describe the test of alkyne	3. Chemical properties-Combustion, hylogenation, catalytic hydration, with Br_2 solution, with Na, with tollens reagent, with Bayer's; reagent, ozonlysis polymerization, with Cl_2 4. Markovnikov's rule. 5. Uses of ethyne in life
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
2.6: Alkyl halides	**Hrs. theory 1**
Objectives	Contents
1. List the properties and uses of ethyl iodide. 2. Introduction of alkyl halides	1. Definition of alkyl halides. With example. 2. uses of alkyl halides
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
2.7: Alcohol	**Hrs. theory 3**
Objectives	Contents
1. Classify alcohols 2. Explain the process of fermentation.	1. Classification of alcohol as-monohydric, dihydric, polyhydric, primary, secondary and tertiary 2. Identification of primary, secondary and tertiary alcohol by oxidation method 3. Physical properties of ethanol 4. Chemical properties- Oxidation, with sodium, with oxygen, with H_2SO_4, CH_3COCl, CH_3COOH, combustion
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
2.8: Carbonyl compound	**Hrs Theory 4**
Lesson: A Formaldehyde & Acetaldehyde	Hrs. theory 2
Objectives	Contents
1. Describe the physical and chemical properties of formaldehyde. 2. List uses of formaldehyde.	1. General methods of preparation 2. Physical properties. 3. Chemical properties-with ammonia, with NH_4OH, NaOH, Polymerisation. 4. Uses in everyday life.
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
Lesson B. Acetone (Ketone)	Hrs. Theory 2 Hrs. lab
1. Identify ketonic compounds.	3. Preparation from isopropyl alcohol and Ca-acetate

2. Describe the physical and chemical characterstics of ketonic compound. 1. List the uses of ketonic compounds.	4. Physical properties 5. Chemical properties with $NaHSO_3$, Phenyl hydrazine 6. Uses in everyday life
2.9: Carboxylic acid Acetic Acid	**Hrs theory 2**
Objectives	Contents
1. Identify the homologue of aliphatic nomocarbocyhlic acid. 2. Describe the physical properties of acids (solubilty, acidic character). 3. Describe the uses of vinegar. Q. Write down the uses of acetic acid.	1. Preparation from acetylene and ethanol 2. Physical properties 3. Chemical properties with-$NaHSO_3$, NH_3, C_2H_5OH, PCl_5 and reduction, acidity of carboxylic acid 4. Uses in everyday life 5. Uses of formic acid in everyday life 6. Natural sources of acetic acid
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
2.10: Amines.	**Hrs. theory 2**
Objectives	Contents
1. Identity the organic bases. 2. Identify the 1, 2 and 3 amines and their names.	1. Nomenclature and classification of amines 2. Basically of amines 3. Examples of amines
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration.
2.11: Natural Products chemistry	**Hrs. theory 4**
Objectives	Contents
1. make a list of medicinal plants. 2. Introduction of phytochemical techniques 3. define alkalides, steroids, and antibiotics.	1. List of Medicinal Plants in Nepal 2. Phytochemical Technique; Extraction, Isolation, Purification, and charaterisation of Natural products 3. Introduction about alkaloids, steroids, antibiotics
Evaluation methods: writtent exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration.
Unit 3: Organic Chemistry	**Hrs. theory 7**
3.1: Ether	**Hrs. theory 2**
Objectives	Contents
1. Identify homologue of ether with their common and IUPAC name 2. Describe the physical and chemical properties	1. Lab preparation of diethylether from ethanol 2. Physical properties 3. Chemical Properties with Combustion, hydrolysis, reaction with HI and PCl_5 4. Uses in medicine and everyday life

Evaluation Methods: Written tests, home assignments, Performance observation (interaction and participation in the class)	**Teaching/Learning activities and recourses:** Classroom instruction, problem solving exercise and demonstrations
3.2: Aromatic Compounds	**Hrs. theory 5**
Lesson A: Introduction	Hrs. Theory 3
Objectives	Contents
1. Define aromatic compound &List the characteristics. 2. Identify the name of aromatic compounds and some heterocyclic compounds.	1. Aromatic compounds 2. Nomenclature of benzene derivatives (Mono, di and tri-substituted) 3. Explain Benzene nucleus and side chain 4. To define heterocyclic compounds. 5. Characteristics of aromatic compounds 6. Differences between aliplatic and aromaticlomped 7. Nomenclature and examples of different aromatic compounds
Lesson B: Benzene	Hrs. Theory 2
1. Describe the preparation, properties and uses of Benzene	1. prepare atiob of benzene 2. Kekule structure of benzene 3. Physical properties of benzene 4. Chemical Properties- Halogenations, nitration, sulphonation, Friedal craft's reaction, Combustion and hydrogenation 5. Uses in everyday life
Evaluation Methods: Written tests, home assignments, Performance observation (interaction and participation in the class)	**Teaching/Learning activities and recourses:** Classroom instruction, problem solving exercise and demonstrations
Unit 4: Chemical Thermochemistry	**Hrs. theory 5**
Objectives	Contents
• Match the systems, surroundings and boundaries • Identify whether heat is evolved or absorbed when salt is added to water • Identify that energy is evolved in any combustion process • Explain first law of thermodynamics • Elaborate Hess's law of heat summation	• Introduction • Enthalpy and enthalpy change, exothermic and endothermic reactions, heat of combustion and its application, heat of formation, heat of neutralization and heat of solution, bond energy • First law of thermodynamics • Hess's Law
Evaluation Methods: Written tests, home assignments, Performance observation (interaction and participation in the class)	**Teaching/Learning activities and recourses:** Classroom instruction, problem solving exercise and demonstrations
Unit 5 :Inorganic Chemistry	**Hrs. theory 15**
5.1: Water	**Hrs. theory 3**
Objectives	Contents
1. Explain the hardness of water 1. Describe the chlorination of water 2. List advantage and disadvantage of hard water	Soft and hard water The process of removal of hardness: - Boiling, Clark's process using

3. Explain the method of purification of drinking water 4. Define degree of hardness of water 5. Define heavy water	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
Evaluation methods: written tests, written assignments, performance observation	**Teaching/Learning activities and resources:** classroom instruction, problem solving exercises, demonstrations
5.2.: Minerals	**Hrs. theory 3**
Objectives	Contents
1. Describe the need of minerals 2. Find their sources and importance.	1. Sources of the followings minerals-Na, K, Ca, Mg, Fe, Zn, Ni, Cobalt 2. Biological importance and effects due to their deficiency
Evaluation methods: written tests, written assignments, performance observation	**Teaching/Learning activities and resources:** classroom instruction, problem solving exercises, demonstrations
5.3: Soil Chemistry	**Hrs. theory 3**
Test the acidic and basic nature of soil	1. Soil test 2. Treatment of soil 3. Causes of acidity of soil 4. Plants in acidic and basic soil.
5.4: Chemical fertilizers	**Hrs. theory 3**
Objectives	Contents
Use the chemical fertilizer effectively	Chemical fertilizers NKP Fertilizers. Role of Fertilizers in plant or vegetation Advantage and disadvantage of chemical fertilizer.
5.5: Cycles and Elements	**Hrs. theory 3**
Objectives	Contents
Identify of Natural cycles or green house effect.	i) Oxygen Cycle ii) Nitrogen Cycle iv) Carbon Cycle and v) Water cycle

Chemistry Practical **Hrs Lab 78**

A. General Chemistry Practical	
Practical 1: Introduction	Hrs. lab 5
Objectives	*Contents*
1. Follow stated laboratory procedures and guidelines 2. Describe safety and first aid measures for the chemistry lab	1. Procedural rules and guidelines of the chemistry lab 2. Proper handling of equipment 3. Lab safety measures

3. Demonstrate the methods for chemistry lab documentation	4. Documentation procedures for laboratory work
Evaluation methods: Written and viva exams, performance observation in laboratory settings.	**Teaching/Learning activities and resources:** Classroom instruction, textbook self-study, demonstration and return demonstration, laboratory practice problem solving.
Practical 2: Use of Bunsen burner	**Hrs. lab 4**
Objectives	*Contents*
1. Identify the names and functions of the parts of a Bunsen burner. 2. Describe the correct use of the Bunsen burner and its flame with: • airs holes closed. • with airs holes open Differentiate between the uses of oxidizing and non-oxidizing flames.	1. The correct operation of the Bunsen burner. 2. Parts of the Bunsen burner 3. Oxidizing and non-oxidizing flames
Evaluation methods: Written and viva exams, performance observation in laboratory settings.	**Teaching/Learning activities and resources:** Classroom instruction, textbook self-study, demonstration and return demonstration, laboratory practice problem solving.
Practical 3: Simple lab operation	**Hrs. lab 15**
Objectives	*Contents*
1. Separate sand and common salt in pure and dry states from mixture of sand and common salt. 2. Separate sand and camphor from a mixture of sand and camphor 3. Recover the precipitate obtained in pure and dry state when the given solution -A is treated with excess of solution-B a. Solution-A= $BaCl_2$ b. Solution-B =H_2SO_4 2. Prepare a sample of clearly pure distilled water from impure water and carry out the test for purity of water thus prepared. 3. Prepare a sample of bazaar copper sulphate at laboratory temperature and use the solution to get pure crystals of salts. 4. Obtain sodium chloride by the neutralization of: a. Bench of hydrochloric acid	1. The process and methods of filtration 2. Characteristics of filtrate and residue 3. Chlorides ion test. 4. Nature of mixtures and components 5. Principles and processes of sublimation 6. Characteristics of sublimation 7. Characteristics of precipitation 8. Principles and process of precipitation. 9. The distillation process 10. Properties of pure water 11. Characteristics of saturated solutions 12. Crystallization point and crystallization process 13. Acid base reactions 14. The principles and process of evaporation. 15. Characteristics of soluble and insoluble salts

with a bench of sodium hydroxide. b. Sodium carbonate with hydrochloric acid 5. Prepare a soluble derivative of barium carbonate and sodium chloride	
Evaluation methods: Written and viva exams, performance observation in laboratory settings	**Teaching/Learning activities and resources:** Classroom instruction, textbook self-study, demonstration and return demonstration, laboratory practice problem solving.
B. Physical Chemistry-Practical	
Practical 1: Equivalent weights	Hrs. theory **Hrs. lab 8**
Objectives	Contents
1. Use a chemical balance to weigh various substances. 2. Determine the equivalent weight of a given metal by the hydrogen displacement from acid method	1. The operation of a chemical balance scale 2. The meaning of equivalent weight 3. Calculation of equivalent weights
Evaluation methods: Written and viva exams, performance observation in laboratory settings	**Teaching/Learning activities and resources:** Classroom instruction, textbook self-study, demonstration and return demonstration, laboratory practice problem solving.
Practical 2: Acidimetry and alkalimetry	**Hrs. theroy Hrs lab 8**
Objectives	Contents
1. Standardize the given acid, which is approximately decinormal. 2. Determine the strength of alkali with the help of a standard acid supplied. 3. Determine the strength of acid in terms of: a. Normality b. Grams/liter c. Percentage	1. Process of titration 2. Acidimetry and alkalimetry 3. Known and unknown solutions 4. Substances with primary and secondary standards 5. Preparation of solutions of various strengths 6. Calculation of strengths of unknown solutions in terms of normality, molarity, molarity, gram/liter, and percentage
Evaluation methods: Written and viva exams, performance observation in laboratory settings	**Teaching/Learning activities and resources: C**lassroom instruction, textbook self-study, demonstration and return demonstration, laboratory practice problem solving
C. Organic Chemistry-Practical	
Practical 1: Element detection	Hrs. theory **Hrs lab 8**
Objectives	Contents
1. Detect the elements present in given organic compounds.	1. Process for detection of nitrogen, sulphur, halogens. 2. Selected chemical tests.

Evaluation methods: Written and viva exams, performance observation in laboratory settings	**Teaching/Learning activities and resources:** Classroom instruction, textbook self-study, demonstration and return demonstration, laboratory practice problem solving.
Practical 2: Identification of organic compounds	Hrs. theory **Hrs. lab 8**
Objectives	**Content**
1. Identify given organic compounds	1. The identification of acetate, formate, formaldehyde, oxalate, oxalic acid, glycerol, acetone, ethyl alcohol, acetic acid, formic acid 2. Selected chemical tests
Evaluation methods: Written and viva exams, performance observation in laboratory settings	**Teaching/Learning activities and resources:** Classroom instruction, textbook self-study, demonstration and return demonstration, laboratory practice problem solving.
Practical 3: Techniques of phytochemical screening	**Hrs. 14 lab**
Objectives	*Contents*
Describe different techniques on phytochemical screening of some medicinal plants	• Simple techniques discussion on phytochemical screening of some medicinal plants
Evaluation methods: practical performance, test, viva	Teaching learning activities and resources: classroom instruction, demonstration.
Practical 4: Listing medicinal plants and their uses	**Hrs. 4 lab**
Objectives	*Contents*
Make a list of some medicinal plants and their extracts and their biological uses	• Making a list of some medicinal plants their extracts and biological uses
Evaluation methods**:** practical performance, test, viva	Teaching learning activities and resources**:** classroom instruction, demonstration.
Practical 5: P4 value of the soil	**Hrs. 4 lab**
Objectives	*Contents*
Find the values of the given sample of the soil	• To find the P4 value of the given sample of the soil.
Evaluation methods: practical performance, test, viva	Teaching learning activities and resources: classroom instruction, demonstration.
Evaluation methods: oral and written tests, home assignments.	**Teaching learning activities and resources:** classroom instruction, discussion,,, textbook, and reference book self study.

Zoology

Total hours: 195 **Full Marks: 100**
Theory 117
Practical: 78

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 and the relationships between organisms and environment , and a detailed study of the anatomy and physiology of earthworm and mammals.

Course Objectives

Practical zoology includes the study of microscope, study of museum specimens- Invertebrates and Vertebrates, with the objective that students become proficient in identification of common organisms with their local, nepali, English and scientific names

- tell the meaning, scope and different branches of zoology
- explain structure and function of different kinds of tissues in a body
- identify diversified forms of animal life
- explain different systems of mammals
- describe how organisms of today have been evolved from the ancestral ones
- describe the relationships of organism with their surrounding
- handle microscope properly
- identify different kinds of animals
- prepare temporary slide mount of the given specimen
- dissect the mammal so as to expose its different systems

Recommended Text Books:

1. Keshari Arvind-*A textbook of Zoology for health sciences*, Vidyarthi Pustak Bhandar
2. Shrestha Raghubar; Ghimire Suvas Chandra- *United Zoology for health sciences*, United Nepal Publications (P.) Ltd.
3. Kotpal, R. L., *Modern Text Book of Zoology, Invertebrates*, Rastogi PublicationsKotpal R. L., *Modern Text Book of Zoology, Vertebrates*, Rastogi Publications - Keshari A., *Practical Biology*, Vidyarthi Publication
4. Verma P. S., *Practical Zoology (Invertebrate)* – S Chand and Company Pvt. Ltd.Verma P. S., *Practical Zoology (Chordate)*, S Chand and Company Pvt. Ltd.
5. Sharma Subodh- *A handbook of practical zoology*, Himalaya Book StallLabh Shyam Narayan- *A Textbook of Practical Biology*, Taleju Prakashan.
6. Keshari Arvind, Khaga Raj Ghimire, Bijay Shankar Mishra- *Practical Biology for class XI*, Vidyarthi Pustak Bhandar

Reference Books:

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

7. Agrawal V. K. and Gupta V. - *Ecology and Ethology*, S Chand and Company Ltd.

Course Contents

Course: Zoology	**Theory: 117 Hrs Practical: 78 Hrs**
Unit 1: introduction to zoology	**Hrs. 6 theory**
1.1: Definition, scope and branches of Zoology	**Hrs. 4 theory**
Objectives	***Contents***
State the meaning of zoology Describe the branches and fields of biology and their scopes.	1.1.1 Meaning of zoology, Scope of zoology, 1.1.2 Different branches of zoology: Morphology, anatomy, physiology, cytology, Histology, embryology, Hepatology, Herpetalogy, , parasitology, entomology, Helminthology, proto-zoology, Bacteriology, virology, paleontology, ecology, genetics, toxicology
1.2: Introduction to Preservation Techniques	**Hrs. 2 theory**
Objectives	***Contents***
Define preservation Understand importance of preservation List different types of common preservation techniques	1.2.1 Definition and importance of preservation 1.2.2 Types of common preservation techniques- Wet and Dry methods 1.2.3 Protocol of following preservation techniques: 1.2.3.1Dry and Wet preservation for different groups of organismsLower invertebrates; higher invertebrates- arthropodans, Molluscans, Echinodremats; Vertebrates 1.2.3.2 Taxidermy
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion textbook, powerpoint presentation, and reference book self study.
Unit 2: Cell biology	**Hrs. 17 theory**
2.1: Introduction to cell	**Hrs. 5 theory**
Objectives	***Contents***
Explain that cell as a basic unit of life, Differentiate between plant cell and animal cell. Differentiate between prokaryotic and eukaryotic cell. Differentiate between cytoplasm and nucleoplasm	2.1.1 Basic structure of prokaryotic and eukaryotic cell 2.1.2 Structure of different cell organelles and their functions: Cytoplasmic contents: cellmembrane, mitochondria, endoplasmic reticulum, glogi complex, liposome , centrosome, vacuoles, cilia and flagella Nucleoplasmic contents: chromosomes, nucleolus, nuclear membrane 2.1.3 Meaning of Cyclosis, endocytosis, exocytosis
Evaluation methods: oral and written tests, home assignments.	**Teaching learning activities and resources:** classroom instruction, discussion, textbook, and reference book self study.

2.2: Cell division	**Hrs. 7 theory**
Objectives	***Contents***
Define cell cycle, amitosis, mitosis and meiosis. Describe amitosis cell division. Explain the significance of amitosis cell division. Describe the steps of mitotic cell division using a labeled diagram. Explain the significance of mitosis. Describe the steps of meiotic cell division with necessary sketches. Explain why meiosis is called reductional division and is important in sexually reproducing organisms. Explain the significance of meiosis. Distinguish between mitosis and meiosis.	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
Evaluation methods: oral and written tests, home assignments.	**Teaching learning activities and resources:** classroom instruction, power point presentation, discussion, textbook, and reference book self study.
2.3: Tissues and their types	**Hrs. 5 theory**
Objectives	***Contents***
Define tissue. Name different types of tissues (epithelial tissues, connective tissues, muscular tissues, nervous tissues). Distinguish between different types of tissues, their important functions and their location in mammalian body e.g Human	2.3.1Definition 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 epitheliumFunctions 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. 2.3.5 Flow chart of types of tissues and its subtypes
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbook and reference book self study.
Unit 3: Diversity of animal life	**Hrs. 12 theory**
3.1: Concept of taxonomy	**Hrs. 8 theory**
Objectives	***Contents***
Define taxonomy Define species as a basic unit of classification.	3.1.1 Definition of taxonomy, species as a basic unit of classification, systematics, taxon, lower and higher taxa, order of different taxa

Distinguish between artificial and natural classification List modern criteria for classification of animals Define the terms used in classification.	3.1.2 Describe the evolution of system of classification and need for classification 3.1.3 Different systems of classification- Artificial, Natural and Mordern classification Basis of classification in different systems 3.1.4 Differences between artificial and natural systems of classification
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources**: classroom instruction, discussion, textbook/ reference books self study.
3.2: Binomial nomenclature and classification.	**Hrs. 4 theory**
Objectives	***Contents***
Define binomial nomenclature. Identify the importance of nomenclature. Identify the system adopted by the International Code of Zoological Nomenclature. Write scientific names of commonly found animals. Describe each of the five kingdoms of classification with examples.	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-Lion; Tiger, Leopard, Fox, Cat, Dog, 3.2.4 Five kingdom system of classification. 3.2.4.1 Chief characteristics and examples of five kingdoms.
Evaluation methods: Oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbook, and reference book self study.
Unit 4: Animal phylogeny and classification	**Hrs. 12 theory**
4.1: General characteristics and classification of different phyla of animals.	**Hrs. 12 theory**
Objectives	***Contents***
List the general characters of the phyla (Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Chordata). Classify phylums upto classes	4.1.1 General characters of phylum Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Chordata. 4.1.2 List the classes of each phylum and two common examples of each.
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbook, and reference book, self study.
Unit 5: Basic concept of origin and evolution of life.	**Hrs. 12 theory**
Objectives	***Contents***
Define evolution and organic evolution. Describe the evidences of organic evolution: Describe the Lamark's theory of evolution Giving examples and identify it's drawbacks. Identify the key message of Darwin's theory of evolution with examples.	5.1 Describe origin of life and its theories: Oparin and Haldane theory; Miller-Urey experiment efine evolution and organic evolution 5.3 Evidences of organic evolution: morphological, anatomical, palaeontolgical, biochemical, genetic and embryological. 5.4 Describe different theories of organic evolution-

Identify drawbacks of Darwin's theory of evolution. Explain modern synthesis theory of evolution. Describe the evolution of man	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 timeperiod 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 erectus or pithecanthropus erectus); Peking man (Homo erectus pekinensis or Sinanthropus pekinensis); Neanderthal man (Homo sapiens neanderthalensis); Cro-Magnon man; Modern man
Evaluation methods: oral test, home assignments, written examination.	**Teaching learning activities and resources:** classroom instruction, discussion, textbook, and reference book self study.
Unit 6: Study of Earthworm	**Hrs. 6 theory**
Objectives	***Contents***
Give the systematic position, habit and habitat of earthworm. Describe the morphology of earthworm with sketch. Define digestion and describe the digestive system of earthworm. List the organs involved in the digestive system. Describe the physiology of digestion in earthworm. Describe the male reproductive organs and female reproductive organs of earthworm. Describe physiology of reproduction in earthworm Describe the nervous system of earthworm. Give the economic value of earthworm.	6.1 Systematic position habit, habitat, external features. 6.2 Structure, organs and physiology of digestive system, reproductive system, and nervous system 6.3 Economic importance of earthworm.
Evaluation methods: oral test, home assignments, written examination.	**Teaching learning activities and resources:** classroom instruction, discussion, textbook, and reference book self study.
Unit 7: Study of some economically important insects.	**Hrs. 4 theory**
Objectives	***Contents***
Give the systematic position, habit and habitat of Honey bee and Silk worm. Describe the morphology of Honey bee and Silk moth with sketch. Economic importance of Honey bee, Silk moth Characters of silk thread.	7.1 Systemic position, habit and habitat, morphological structure, life cycle and economic importance of 7.1.1 Honeybee and 7.1.2 Silkworm.

Evaluation methods: oral test, home assignments, written examination.	Teaching learning activities and resources: classroom instruction, discussion, textbook, and reference book self study.
Unit 8: Study of life process of mammals	**Hrs. 14 theory**
Objectives	***Contents***
Give the systematic position and morphology of man with sketch. Describe the digestive system, respiratory system, circulatory system reproductive system and excretory system of man.	8.1 Systemic position and morphology of man. 8.2 Structure, organs and physiology of Digestive system. Respiratory system. Circulatory system. Reproductive system and Excretory system 8.3 Introudction to Endocrine System- List different glands and its major role in human body 8.4 Nervous system- Basic structure and organs involved. Its major function in human body
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbook, and reference book self study
Unit 9: Ecology and environment	**Hrs. 22 theory**
9.1: Ecosystem	**Hrs. 8 theory**
Objectives	***Contents***
Define ecosystem and its types. Identify major types of ecosystem- aquatic and terrestrial ecosystems List abiotic and biotic factors of different ecosystems. Identify the interacting system of biotic factors: Positive interactions-commensalism, mutalism, colonization, and social organization Negetive interactions- predation, parasitism, competition and antibiosis. Define food chain and trophic level. Develop a diagrammatic representation of food chain. Describe energy and energy relations in an ecosystem.	9.1.1 Structural and functional organization of ecosystems- Components of ecosystem Abiotic and biotic factors of ecosystem and their interrelationships. 9.1.2 Study the various components and its interactions in pond ecosystem and Grassland ecosystem as examples of Aquatic and Terrestrial ecosystems. 9.1.3 Define Food chain, trophic level and describe energy flow in an ecosystem--- 9.1.3.1Concept of ecological pyramid- its types 9.1.4 Describe the interaction between biotic factors: 9.1.4.1 Positiveinteractions- commensalism, mutualism, colonization, and social organization 9.1.4.2 Negative interactions- predation, parasitism, competition and antibiosis.
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbook, and reference book self study.
9.2: Ecological imbalances and consequences	**Hrs. 6 theory**
Objectives	***Contents***
To understand the mechanism, causes, consequences of the greenhouse effect.	9.2.1 What is greenhouse effect, acid rain and depletion of ozone layer? 9.2.2 Importance of Greenhouse effect and ozone layer for life on earth.

Discuss the significance of green house effect, and explain why many scientists believe it will create a global crisis. Define the acid rain, causes and its effects. State the importance of the ozone layer for living organisms. Describe how some scientists' believe the ozone layer is going to deplete. Describe the consequences of the depletion of the ozone layer.	9.2.3 Description of the mechanism of greenhouse effect, acid rain and depletion of the ozone layer. 9.2.4 Causes and consequences of greenhouse effect, depletion of ozone layer and acid rain.
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbooks, and reference books self study.
9.3: Environmental pollution	**Hrs. 6 theory**
Objectives	***Contents***
Define pollution. List biodegradable and nonbiodegradable pollutants. Identify the source of water pollution. List the effects of water pollution List the preventive measures to control the water pollution. Identify the source of air pollution. List the effects of air pollution Mention the preventive measures to control air pollution. Identify the sources, effects and control meausres of soil pollution.	9.3.1 Definition of pollution 9.3.2 Types of pollution- Air, water, Land/ Soil, Radioactive Pollution 9.3.3 Source of water pollution, their effect and preventive measures. 9.3.4 Source of air pollution, their effect on living organisms and preventive measures of air pollution. 9.3.5 Sources of soil pollution, their effects on living porganisms and preventive meausres of soil pollution 9.3.6 Sources of soil pollution, their effects on living porganisms and preventive meausres of Radioactive pollution
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbook, and reference book self study.
Unit 10: Animal adaptation	**Hrs. 6 theory**
Objectives	***Content***
Define adaptation. Define aquatic adaptation and describe adaptational characteristics with examples. Define the terrestrial adaptation. List the different types and adaptational characteristics of terrestrial adaptations along with examples.	10.1 Meaning of adaptation 10.2 Explanation of the adaptational features and examples of aquatic adaptation 10.3 Explan the types and adaptational features of terrestrial adaptation- Aerial/ Volant, Desert, Arboreal, Fossorial, Cursorial with examples
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbook, and reference book self study.
Unit 11: Animal behavior	**Hrs. 4 theory**
Objectives	***Contents***
Define the reflex action. Define the taxis and their types. Explain leadership and qualities of a leader. List some common examples of leadership in animals.	11.1 Definition of learned behavior and inborn behavior 11.2 Definition of reflex action 11.3 Definition of taxis and its types 11.4 Definition of Leadership and the qualities of leader

	11.5 Discuss common examples of leadership in animals
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbooks, and reference books self study.
Unit 12: Conservation of wildlife	**Hrs. 4 theory**
Objectives	***Contents***
Define wildlife. Define the endangered species. List the endangered species of Nepal and causes of extinction. . Explain the importance of afforestation.	12.1 Definition of wildlife 12.2 Importance of wildlife conservation 12.3 List the endangered species in Nepal and causes of extinction 12.4 What is Forest conservation, importance of afforestation 12.5 Causes and consequences of deforestation.
Evaluation methods: oral test, home assignments, written examination.	**Teaching learning activities and resources:** classroom instruction, discussion textbooks, and reference books self study.

Zoology Practical

Course: Practical Zoology	**Hrs. 78 lab**
Unit 1: Use of the microscope	**Hrs. 4 lab**
Objectives	***Contents***
Name different types of microscope and their parts. Handle a microscope properly. Draw well labelled diagram of microscope	Description of importance of Microscope, it's types, parts of microscope & functions of its different parts, observation techniques. Proper handling of microscope Explain the concept of magnification?
Evaluation methods: practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, demonstration in laboratory.
Unit 2: General study of the animal kingdom	**Hrs. 34 lab**
2.1: Study of permanent slides and museum specimens	**Hrs. 16 lab**
Objectives	***Contents***
Identify the given slides, museum specimens Draw well labelled diagram of given specimens Write down the characters of given specimens slides classify the specimens upto class.	Study of permanent slides: protozoa: Amoeba, Paramecium Study of museum specimens: Porifera-sycon Coelenterata-Hydra Platyhelminthes-Tapeworm, liver fluke Aschelminthes-*Ascaris* Annelida-Earthworm and leech Arthropoda- Butterfly, Crab, Scorpion, Spider, Centipede, Prawn Mollusca –Pila Echinodermata-Starfish Phylum:Chordata Class: Pisces – *Labeo,Exocoetus* Class: Amphibia-Frog,Toad Class: Reptilia-wall lizard. Class: Aves-Pegion,Parrot.

	Class: Mammals-Squirrel, Bat.
Evaluation methods: practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, Observation in lab
2.2: Identification in field	**Hrs. 9 lab**
Objective	***Content***
To identify, classify and give scientific name To know about the common preservation technique	Visit field, take pictures, identify phylum and class of commonly found 10 animals in nearby area, park, forest, Zoo Preparea report on field observation Describe common preservation techniques- e.g. Taxidermy
2.3: Indentification of birds	**Hrs. 9 lab**
Objective	***Contents***
Identify common birds in Nepal	Field visit for bird observation and identification Compile and prepare a report
Evaluation methods: practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, field visit
Unit 3: Study of animal tissues	**Hrs .12 lab**
3.1 Microscopic observation of permanent slides of animal tissues	**Hrs. 6 lab**
Objectives	***Contents***
Study the types of animals tissue Give comments upon the given tissues.	Squamous, columnar, cuboidal, adipose, areolar, hyaline, cartilage, t.s of bone and blood of man.
Evaluation methods: practical performance, test, viva	Teaching learning activities and resources: classroom instruction, Observation in lab
Unit 3.2: Preparation of temporary slides and their study	**Hrs. 6 lab**
Objectives	***Contents***
Prepare the temporary slide. Study the prepared slide Draw the well labeled diagram provide comments on the diagrams.	Squamous epithelium of human cheek Setae of earthworm
Evaluation methods : practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, demonstration and practice in lab.
Unit 4: Dissection of animal	**Hrs. 20 lab**
4.1: Dissection of earthworm	**Hrs. 10 lab**
Objectives	***Contents***
Dissect the earthworm to observe the general anatomy, alimentary canal, reproductive system and the brain (nervous system) of earthworm. Draw the well- labeled diagrams of the given systems and comment on their.	Instruments used for dissection Expose the general anatomy, alimentary canal, male reproductive system, female reproductive system and nervous system
4.2: Dissection of Rat	**Hrs. 10 lab**
Objectives	***Contents***
Dissect and observe the general anatomy alimentary canal and associated glands, circulatory, system, reproductive system, brain of mammal. Draw the well- labeled diagram.	Instruments for dissection. Exposure of general anatomy, alimentary canal, arterial, system, venous system, male and female reproductive system and brain.

Evaluation methods: practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, demonstration, self practice in lab
Unit 5: Study of an ecosystem	**Hrs. 12 lab**
5.1: Pond ecosystem	**Hrs. 4 lab**
Objectives	***Contents***
Define ecosystem Name/List/Give/etc, the abiotic and biotic factors of an ecosystem Define aquarium -Draw the well labeled diagram to show the food chain in pond ecosystem.	Abiotic factors of a pond. Biotic factors of pond. Study Aquarium as a pond ecosystem. Differences in real pond and aquarium as a pond ecosystem.
5.2: Grassland ecosystem	**Hrs. 4 lab**
Objectives	***Contents***
Define ecosystem. Define of grassland ecosystem. Tell the abiotic and biotic, factors. Draw a diagram to show the food chain in grassland ecosystem.	Abiotic and biotic factors of a grassland ecosystem Food chain of grassland ecosystem
Evaluation methods: practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, demonstration in field.

Botany

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

Course Description:
This course aims at providing basic knowledge of Botany to certificate level students of Forestry. The course is divided into nine units. The first unit gives introduction of botany. The second unit provides information about molecules of living systems. The third unit tells about different aspects of genetics. Unit four gives the account of biotechnology including tissue culture and genetic engineering. The fifth unit provides information on plant anatomy. Unit six is about physiology, which covers knowledge about membrane transport, transpiration, photosynthesis and respiration. Unit seven gives the concept of taxonomy, classification and biodiversity and it also provids information about organisms like virus, bacteria, cyan bacteria, and bryophytes, pteridophytes, gymnosperms and angiosperms. This chapter also focuses on morphology of five common taxonomic families. The eighth unit gives information about embryology of angiosperms. The ninth unit gives introduction to economic and ethno botany.

Course Objectives:
After completing this course the students will be able to:

- understand scope of botany, its different branches, and interrelation of botany with other sciences
- understand the structure of plants at molecular, cellular, tissue and organ level of organization
- understand basic principles of genetics biotechnology and plant breeding
- understand basic anatomical features and physiological process in plants
- understand concept of taxonomy and biodiversity
- understand taxonomic terminologies to describe angiospermic plants
- explain the features of different groups of organisms-virus, bacteria, cyan bacteria, fungi, and all the groups of plants from algae to angiosperms
- know life cycles of some representative plants
- explain different aspects of embryology of angiospermic plants
- know identifying features with their economic importance
- identify some important medicinal plants of Nepal and their uses
- explain about ethnobotany and its importance

Recommended Textbooks:

- Sinha, V. and S. Sinah. *Cytogenetics Plant Breeding and Evolution.* Vikas Publications Ltd, New Delhi.
- 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.

Reference Books

- Chaudhary, R. P. Biodiversity in Nepal Statud and Conservation. S. Devi, Saharanpur (U. P.), India and Tecpress Books, Bangkok, Thailand.
- Pandey, B. P. Plant Anatomy. S. Chand and Company Ltd, New Delhi, India.

- Pandey, B. P. Economic Botany. S. Chand and Company Ltd, New Delhi, India.
- Alexopolos, C. J. Introductory Mycology. John Wiley and Sons, New York.
- Vasishta, P. C. Botany for Degree Students (vol 5) Gymnosperms. S. Chand and Company Ltd, New Delhi, India.
- 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.
- Jain, J. L. Fundamentals of Biochemistry. S. Chand and Company Ltd, New Delhi, India.
- HMG, Nepal. Medicinal Plants of Nepal. DPR, HMG, Nepal.
- Toylor D.J., N.P.O. Green and G.W.S Stout. Biological science (Third Edition). Cambridge University Press.

Course Contents

Unit 1: Introduction to Botany	**Theory: 3 hrs**
1.1: Definition and Scope of Botany	**Theory: 3 hrs**
Objectives	Contents
Define Botany. Explain the importance of Botany. Explain the importance of plants. List and define major branches of botany on the basis of field of study and plant groups. Describe the interrelationship between different branches of Botany. Discuss the relation of Botany with other sciences like Physics, Chemistry, Statistics, etc.	Definition of Biology and Botany Definition of plants Importance of Plants Scope and importance of Botany Different branches of Botany and their interrelationships Relationship of Botany with other sciences
Evaluation: Oral and written tests, home assignments.class work	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams, visuals, plant materials
Unit 2: Molecular Biology	**Theory: 9 hrs**
2.1: Life Components	**Theory: 1 hrs**
Objectives	**Contents**
Define the terms cellular pool, biomolecules, micro-molecules and macromolecules with examples. List inorganic and organic molecules of the living system. Define monomers and polymers with examples.	Definition of cellular pool, biomolecules, micro and macromolecules, inorganic and organic molecules and monomers and polymers with examples.
Evaluation: Oral and written tests, home assignment.	**Teaching Methods:** Classroom instruction, textbooks, reference books, charts, diagrams, photographs, show items containing relevant biomolecules.
2.2: Genreral Introduction and Function of biomolecules	
2.2.1 Water	**Theory: 1 hrs**
Objectives	Contents
Give structure and properties of water.	Structure, properties and functions of water.

List the functions of water in living systems.	
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams, photographs.
2.2.2: Carbohydrates	**Theory: 1 hrs**
Objectives	Contents
Define carbohydrates. Define monosaccharide, oligosaccharides, and polysaccharides with examples. Define sugars and non-sugars. List functions of carbohydrates.	Definition, types, examples, and functions of Carbohydrates
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams, photographs.
2.2.3: Proteins	**Theory: 2 hrs**
Objectives	Contents
Define proteins as polypeptides. Define essential and non-essential amino acids with examples. List functions of proteins.	Definition, types, examples, and functions of amino acids and proteins.
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials :** Classroom instruction, textbooks, reference books, charts, diagrams, photographs.
2.2.4: Lipids	**Theory: 1 hrs**
Objectives Differentiate fats and oils. List functions of Lipids.	Contents Definition, types, examples, and functions of Lipids.
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams, photographs.
2..2.5: Nucleic acids	**Theory: 3 hrs**
Objectives	Contents
Define nucleic acids as polynucleotides. List components of Nucleotides. Define and differentiate DNA and RNA. Define denaturation and renaturation of List function of Nucleic acids.	Definition, types, examples and functions of Nucleic acids Definition glycosidic, peptide and phosphodiester bonds. Definition of Replication, Transcription and Translation
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams, photographs.
Unit 3: Genetics	**Theory: 12 hrs**
3.1: Heredity and Variation	**Theory: 4 hrs**
Objectives	Contents
Define heredity and variation. Explain causes of variation like environmental causes, mutation (gene and chromosomal), polyploidy etc.	Definition of heredity and variation Explanation of causes, types, and significance of variation

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.	Definition of terms: chromosome, gene, alleles, genotype, phenotype, and homozygous, heterozygous, clone
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams.
3.2: Mendel's Law of Inheritance	**Theory: 4 hrs**
Objectives	Contents
Explain Mendel's experiments. List the reasons for selecting pea plant by Mendel in his experiment. Define hybridization. Define monohybrid and dihybrid crosses. Mendel's laws: Law of dominance, Law of Segregation, law of independent assortment.	Description of Mendel's hybridization experiments-monohybrid and dihybrid crosses Description of Mendel's laws and ratios
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, and diagrams, show pea plants and introduce its different parts.
3.3: Introduction to Plant Breeding	**Theory: 4 hrs**
Objectives	Contents
Define plant breeding. List and define the methods of plant breeding. Discuss the significance of plant breeding.	Definition, scope, significance and methods of plant breeding
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, and diagrams.
Unit 4: Biotechnology	**Theory: 6 hrs**
4.1: Introduction to Biotechnology	**Theory: 3 hrs**
Objectives	Contents
Define Biotechnology. List the branches of Biotechnology. List the application of Biotechnology.	Definition, branches and applications of Biotechnology.
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, and diagrams.
4.2: Plant Tissue Culture	**Theory: 3 hrs**
Objectives	Contents
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.	Definition of in *vitro* culture, cell, tissue and organ culture. Definition of cellular totipotency. Definition of culture media. Signification of sterilization and its techniques. Micropropagation and its applications. Application of Plant tissue culture.

Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams and photographs. Equipments can also be shown.
Unit 5: Plant Anatomy	**Theory: 13 hrs**
5.1: Tissue and its types	**Theory: 6 hrs**
Objectives:	Contents
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 ypes of vascular bundles- radial, conjoint (collateral, bicollateral and concentric); open and closed.	Definition of tissue Types of tissues- Meristematic, permanent and secretory Features of Meristematic tissues. Types and examples of Meristematic tissues- apical, intercalary and lateral; primary and secondary Classification of permanent tissues as simple and complex Basic features, distribution and function of different simple and complex permanent tissues Definition of secretory tissues Types of secretary tissues, their examples and importance. Definition of primary and secondary tissues. Types of Xylem- protoxylem and metaxylem; exarch, endarch, mesarch and centrarch. Vascular bundles and its elements-xylem, phloem and cambium. Types of vascular bundles- radial, conjoint (collateral, bicollateral and concentric); open and closed.
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams.
5.2: Internal structure of dicot and monocot root and stem.	**Theory: 4 hrs**
Objectives	Contents
Describe internal structures of dicot and monocot stems. Describe internal structure of dicot and monocot stems.	Internal structures of dicot and monocot stems Internal structure of dicot and monocot stems
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams.
5.3: Anatomy of Dorsiventral and Isobilateral leaves	**Theory: 2 hrs**
Objectives	Contents
Describe internal structures of dicot and monocot stems. Describe internal structure of dicot and monocot stems.	Internal structures of dicot and monocot stems. Internal structure of dicot and monocot stems.

Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams.
5.4: Secondary growth	**Theory: 1 hrs**
Objectives	Contents
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.	Definition of secondary growth. Role of cambium and cork cambium in the secondary growth of dicot root and stem. Annual rings and their formation.
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials.** Classroom instruction, textbooks, reference books, charts and diagrams.
Unit 6: Physiology	**Theory: 14 hrs**
6.1: Transport across the cell membrane	**Theory: 5 hrs**
Objectives	Contents
Define diffusion and list its importance in living systems. Define concentration gradient. List the factors affecting diffusion. Define facilitated diffusion and osmosis. Define 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. Define bulk transport and its types- Endocytosis and Exocytosis, Phagocytosis and Pinocytosis.	Definition of diffusion, concentration gradient and facilitated diffusion Factors affecting diffusion. Significance of diffusion. Definition of Osmosis and related terms like, semipermeable, osmosis pressure, water potential, hypo- and hypertonic solution, endo- and exosmosis, plasmolysis, turgid and flaccid cells Definition of active transport and its significance Definition of bulk transport, its types, exo- and endocytosis, phago- and Pinocytosis
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, and diagrams, demonstration of diffusion and osmosis.
6.2: Transpiration	**Theory: 2 hrs**
Objectives	Contents
Define transpiration. Define stomatal, lenticular and cuticular transpiration. Describe factors affecting transpiration. Describe the significance of transpiration.	Definition of transpiration and its types. Factors affecting transpiration. Significance of transpiration.
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams and demonstration of transpiration.
6.3: Photosynthesis	**Theory: 3 hrs**
Objectives	Contents
Define Photosynthesis. List some major photosynthetic pigments and identify their role.	Definition of Photosynthesis. Major photosynthetic pigments and their roles

Identify the sites of photosynthesis. Mechanism of photosynthesis List the major steps of photosynthesis. List the factors affecting photosynthesis.	Sites of Photosynthesis-grana and stroma of chloroplast Major steps of photosynthesis- trapping of light, light reaction, photolysis of water, photophosphorylation and dark reaction (Calvin cycle) (detail steps and mechanism not required)
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams and demonstration.
6.4: Respiration	**Theory: 4 hrs**
Objectives	Contents
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.	Definition of respiration. Definition of aerobic and anaerobic respiration and their differences Sites of respiration-cytoplasm and matrix and cristae of mitochondria Major steps of aerobic respiration- glycolysis, link reaction, Krebs cycle and oxidative phosphorylation (details and mechanism not required) Major steps of anaerobic respiration-the alcoholic pathway and the lactate pathway
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams and demonstration.
Unit 7: Taxonomy and Biodiversity	**Theory: 48 hrs**
7.1: Concept of Taxonomy	**Theory: 2 hrs**
Objectives:	Contents:
Define plant taxonomy. Give importance of plant taxonomy. Give scope of taxonomy and its importance to other branches of biology. Identify taxonomic hierarchy and categories in plant classification with examples. Define binomial system of nomenclature.	Definition, scope, interrelationship and importance of plant taxonomy Taxonomic hierarchy, categories and examples in plants classification Binomial nomenclature
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams.
7.2: System of classification	**Theory: 2 hrs**
Objectives	Contents
Define artificial, natural and phylogenetic systems of classification with examples.	Artificial, natural and phylogenetic systems of classification Examples of artificial, natural and phylogenetic systems of classification
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Material:** Classroom instruction, textbooks, reference books, charts, diagrams.
7.3: Concept of Biodiversity	**Theory: 4 hrs**
Objectives:	Contents:
Define biodiversity.	

Discuss importance of conserving biodiversity. Give levels of biodiversity- ecosystem and habitat diversity, species diversity and genetic diversity. List and define major types of ecosystems- terrestrial, aquatic, forest, grassland, desert, pond, marine, savannah, and tundra. List protected plant species in Nepal. Define endemic species and list the endemic tree species in Nepal.	Biodiversity, its levels and importance of its conservation Major types of ecosystems Protected plant species in Nepal Definition of endemic species and the list of endemic tree species in Nepal- *Homalium nepaulense, Prunus himalaica and Ormosia glauca*
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams.
7.4: Virus	**Theory: 4 hrs**
Objectives	**Contents**
Define virus. Give general characteristics of virus. Give chemical composition 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.	Definition, general characteristics, chemical composition, and classification of virus Structure of Bacteriophase Process of viral replication Mode of transmission of virus Common viral diseases Economic importance of virus
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams. Diseased plant parts can be shown in class.
7.5: Bacteria and Cyanobacteria	**Theory: 4 hrs**
Objectives	Contents
Define bacteria. Give general characteristics of bacteria. Give the cellular structure of bacteria. Give classification of bacteria based on shape, Gram staining and mode of nutrition. Describe the economic importance of bacteria. Define cyanobacteria. Give general characteristics of cyanobacteria. Give examples of cyanobacteria. Describe the economic importance of cyanobacteria.	Definition, general characteristics of fungi Structure of bacterial cell. Classification of bacteria on shape, Gram staining and nutrition basis Economic importance of bacteria Definition, characteristics and examples of cyanobacteria Economic importance of cyanobacteria
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams. Diseased plant parts can be shown in class.
7.6: Fungi	**Theory: 5 hrs**
Objectives	Contents
Define fungi. Give general characteristics of fungi. Outline the classification of fungi.	Definition, general characteristics and classification of fungi. Life cycle of Yeast.

Describe life cycle of Yeast with labeled diagram. Describe economic importance of Fungi.	Economic importance of fungi.
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams or demonstration. herbarium specimens of diseased plant parts and preserved fungal materials
7.7: Algae	**Theory: 4 hrs**
Objectives	Contents
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* using labeled diagram. Describe economic importance of Algae.	Definition and general characteristics of Algae Distinguishing features of major classes of Algae- Chlorophyceae, Phaeophyceae and Rhodophyceae Structure, reproduction and life cycle of *Spirogyra* Economic importance of Algae
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or materials:** Classroom instruction, textbooks, reference books, charts and diagrams or demonstration. Specimens of algae
7.8: Bryophyta	**Theory: 4 hrs**
Objectives	Contents
Define Bryophyta. Give general characteristics of Bryophyta. Classify Bryophytes as liverworts, hornworts and mosses. List economic importance of Bryophyta. Give structure, reproduction and life cycle of *Marchantia.*	Definition, general characteristics, and classification of Bryophyta as liverworts, hornworts and mosses Economic importance of Bryophyta Structure, reproduction and life cycle of *Marchantia*
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or materials :** Classroom instruction, textbooks, reference books, charts and diagrams. fresh or preserved plant materials
7.9: Pteridophyta	**Theory: 3 hrs**
Objectives	Contents
Define Pteridophyta. Give general characteristics of Pteridophyta. Describe life cycle of fern with well-labeled diagram. Give economic importance of Pteridophytes.	Definition and general characteristics of Pteridophyta Description of life cycle of fern Economic importance of Pteridophytes
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams. fresh plants or preserved specimens
7.10: Gymnosperms	**Theory: 4 hrs**
Objectives	Contents
Define Gymnosperms. Give general characteristics of Gymnosperms.	Definition and general characteristics of Gymnosperms.

List major groups of living Gymnosperms with examples of representative species. Explain systematic position and general morphology of *Pinus*. Define mycorrhizal roots in *Pinus*. Discuss xerophytic anatomical features of *Pinus* needle. Give economic importance of Gymnosperms.	Major groups of living Gymnosperms and representative species of each group Systematic position and general morphology of Pinus Definition of mycorrhizal roots of *Pinus* Xerophytic features of *Pinus* needle Economic importance of Gymnosperms
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams. fresh plants or preserved specimens
7.11: Introduction to Angiosperms	**Theory: 2 hrs**
Objectives	Contents
Define Angiosperms. Give general characteristics of Angiosperms. List differences between dicotyledons and monocotyledons.	Definition and general characteristics of Angiosperms Difference between dicots and monocots
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams
7.12: Morphology of Angiosperms	**Theory: 7 hrs**
Objectives:	Contents:
Describe the angiospermic plants in semi technical terminologies. Habit; Root-(types, modifications); Stem-(types, modifications); Leaf-(types, attachment, arrangement, margin, apex, texture, venation, surface, shape, modification); Inflorescence-(definition, basic types and subtypes); Flower-(attachment, bract, symmetry, sex, position of ovary, arrangement of whorls; Calyx- adhesion, aestivation, duration; Corolla- adhesion, aestivation, shape; Perianth- adhesion, color, aestivation; Androecium- parts of stamen, adhesion, attachment, length, anther cells, attachment of filament, projection; Gynoecium-parts of carpel, adhesion, position of ovary, no of chambers, placentation, types of stigma); Fruit- (definition, basic types and subtypes).	Description of angiospermic plants in semi technical terminologies. habit; general types, parts, features, modifications of root, stem, Leaf, inflorescence, flower
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams. fresh plants or preserved specimens
7.13: Study of some Angiosperm families	**Theory: 5 hrs**
Objectives	Contents
Discuss the characteristic features of some common Angiosperm families with examples and economic importance: Asteraceae, Poaceae, Cruciferae, Solanaceae, Fabaceae.	Description of characteristic features of some common Angiosperm families with habit, habitat, examples and economic importance of each:

	Asteraceae, Poaceae, Cruciferae, Solanaceae and Fabaceae.
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams. fresh plants or preserved specimens
Unit 8: Embryology of Angiosperms	**Theory: 8 hrs**
8.1: Pollination	**Theory: 3 hrs**
Objectives	Contents
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.	Definition of pollination Definition of self and cross-pollination Types of pollination based on pollinating agents Modification of flowers in favor of particular pollinating agent Merits and demerits of self and cross-pollination Mechanisms developed by flowering plants for cross-pollination
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams.
8.2: Fertilization	**Theory: 5 hrs**
Objectives	Contents
Define fertilization. Describe the structure of a typical angiosperm ovule with diagram. List different types of ovules. Describe the process of pollen germination, pollen tube development, double fertilization and triple fusion in angiosperms.	Definition of fertilization. Structure of a typical angiosperm ovule with diagram Different types of ovules Process of fertilization of in angiosperms Double fertilization and triple fusion
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams.
Unit 9: Economic Botany	**Theory: 5 hrs**
9.1: Food Plants	**Theory: 5 hrs**
Objectives	Contents
List some important food plants of Nepal including cereals, pulses, vegetables and fruit plants. List the parts of food value for above-mentioned plants.	Some important food plants of Nepal and their parts of food value.(Cereals, Pulses, Vegetables, Fruits)
Evaluation: Oral and written tests, home assignment.	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams and herbarium specimens of medicinal plants.

Botany Practical

Course: Botany Practical	**Hours: 78**
Practical 1: Biotechnology	**Practical: 10 hrs**
Objectives: List the equipments used in tissue culture. Describe basic technique and processes of tissue culture.	**Contents:** Visit nearby tissue culture laboratory to observe tissue culture in progress. List equipments used in tissue culture.
Evaluation: Viva voce, home assignment and evaluation of mini-report.	**Teaching Methods or Materials:** Field trip and briefing, reference books. Instruction on writing mini-report
Practical 2: Plant Anatomy	**Practical: 11 hrs**
Objectives: 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.	**Contents:** Structure and functioning of a compound microscope Preparation of temporary slides of dicot and monocot stems to study their anatomy Preparation of temporary slides of dorsiventral and isobilateral leaves to study the anatomical structures Study of annual rings in sliced wooden logs of a dicot plant
Evaluation: Viva voce, home assignment, evaluation of slides.	**Teaching Methods or Materials:** Labinstruction, texbooks, charts, use of microscope, show slices of wooden logs.
Practical 3: Physiology	**Practical: 22 hrs**
Objectives Study diffusion using copper sulphate crystals put in a beaker of water. Study osmosis through egg membrane. 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.	**Contents** Study of diffusion using copper sulphate crystals put in a beaker of water Study of osmosis through egg membrane Study of the rate of transpiration under different environmental conditions using Ganong's potometer Demonstration of evolution of oxygen during photosynthesis. OR Demonstration of requirement of carbon dioxide during photosynthesis Demonstration of evolution of carbon dioxide during aerobic respiration Demonstration of evolution of carbon dioxide during fermentation
Evaluation: Viva voce, home assignment, evaluation of lab procedures.	**Teaching Methods or Materials:** Lab instruction, textbooks, charts, use of instruments and equipments.
Practical 4: Taxonomy and Biodiversity	**Practical: 35 hrs**
Objectives **Monera:** Study the different types of bacteria based on their morphology using permanent slides. Study the filaments of *Nostoc* using compound microscope.	**Contents** Classification of bacteria on the basis of shape Study of *Nostoc* under 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. Study of the male and female cone of *Pinus.* Study the morphology and T. S. of *Pinus* needle. **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, Asteraceae and Poaceae).	Study of yeast cells and their budding under compound microscope Study of structure and conjugation in *Spirogyra* using compound microscope Study of structure and reproduction of *Marchantia* using fresh or preserved materials and permanent slides Study the structure and reproduction of fern using fresh or preserved materials and permanent slides Study of male and female cones of *Pinus* Study of morphology and anatomy of *Pinus* needle **Taxonomy of Angiosperms:** Study of some modifications of root, stem and leaf Describe the some angiosperm families in semi-technical terms (Brassicaceae, Solanaceae, Fabaceae, Asteraceae and Poaceae)
Evaluation: Viva voce, home assignment, evaluation of lab activity.	**Teaching Methods or Materials:** Dissecting and compound microscopes, permanent slides, textbooks, lab instructions, charts, fresh or preserved specimens, permanent slides.

Mathematics and Statistics

Total: 195 hours **Full Marks: 100**
Theory: 117 hours
Practical: 78 hours

Course Description
This course is divided into two parts (a) Elementary Mathematic and (b) Elementary statistics. Part one of this course prepares the student to use mathematics skills necessary for application in forestry and part two provides a basic overview of the elementary statistics.

Course Objectives
On Completion of this course the student will be able to:

- apply mathematical Skills to Solve Problems related to Forestry
- demonstrate the basic understanding of the techniques, principle and applications of differential calculus
- demonstrate the basic understanding of the techniques, principle and applications of integral calculus
- solve trigonometrical equations & simple height and distance problems
- define statistics and point out the usages
- define collection, presentation, and interpretation of numerical data with their procedure define collect present or interpret numerical data following approximate procedure

Recommended Texts

- Bajracharya, D.R., et al., Basic Mathematics, for grade XI and XII National Book Centre, Kathmandu.
- DAS & B. C Intermediate trigonometry
- Mahajan B.K. Method of Biostatistics

Part A: (Elementary Mathematics)

Course: Mathematics & Statistics	**Hrs. theory 117 Hrs. lab 78**
Unit1: Mathematics	**Hrs theory 85**
1.1: Revision on Algebra	**Hrs. theory 4**
Objectives	Contents
Ecall the formulae of A.P., G.P. and H.P define ratio and proportion and their properties explain meaning of direct, indirect and joint variations	Formulae of A.P., G.P an H.P. Ratio and proportion and their properties Meaning of direct, indirect and joint variations (No numerical exercise required)
1.2: Set theory and real number system	**Hrs. theory 6**
Objectives	Contents
Define and denote sets. Find subsets of a set and represent the sets in ven-diagrams. Find the union, intersection, complement and difference of given sets. Solve verbal problems using set operations Define real numbers, absolute value, open and Closed intervals and inequalities. Use the concept of set in selected problems.	The concept of sets, specification of sets, representation and types of sets, Venn diagrams. Set operation, set of numbers, Cartesian Products and relation, domain and range of relation. Real number system and the types of numbers, real numbers line, absolute value, open and closed intervals,

Define a set ant given examples. Prove that AU(BUC)= (AUB)UC, where A,B,C are any three non-empty subset. Write the following in set builder form: a) (3,5) b) (-3,9)	Inequalities. (Theorem prof's are not required) Try only exercise I (1), (2), (3) and (4) from the textbook of grade XI
Evaluation Methods: written Assignments to written examination	**Teaching / learning activities and resources:** charts, models, graph boards, diagrams classroom instruction, teachers led discussion, demonstration of solutions illustration through practical examples.
1.3: Function and graph	**Hrs. theory 8**
Objectives	Contents
Define a function Classify function Identify the different functions. Sketch a graph of the various functions. Sketch a graph of trigonometric functions.	Functions and their inverse and related problems Composite functions and related problems Algebraic, trigonometric, exponential and logarithmic function. Try only exercises II (1), (2), and (3) form the textbook of grade XI
Evaluation methods: written assignments to solve related problems, written examination	**Teaching/Learning activities and resources:** Charts, models, graph boards, diagrams, classroom instruction, teacher led discussion, demonstration of solutions, illustration through, practical examples
1.4: Permutation and combination	**Hrs.theory 9**
Objectives	Contents
Describe the basic counting principle. Find the permutation of n-objects taken "r" at a time. Find the combination of n-objects taken "r" at a time, When all objects are different. Find the combination of n- objects taken "r" at a time when all subjects are same. Define permutation and combination of a set of objects Use the relation P (n, r) and C (n, r) with its properties	Introduction of basic counting principle Definition of permutation Formula for finding permutation of n- objects taken r at a time Application of formula in related problems Permutation of repeated use of same objects in an arrangement Meaning of combination Finding general, middle and any particular term in the bionomail expansion Proofs of the relation: P (n, r) and c (n, r) Try only No. 1 to 10 of exercise II (1), (2), and (3)
Evaluation methods: written assignments to solve related problems, written examination	**Teaching/Learning activities and resources:** Charts, models, graph boards, diagrams, classroom instruction, teacher led discussion, demonstration of solutions, illustration through and practical examples
1.5: Matrices and determinants	**Hrs.theory 9**
Objectives:	Contents
Define the term matrix. Write the rows, columns and order of the matrices. Classify matrices according to their properties.	Definition of matrix, notation order, types of matrices and simple algebra of matrices Adjoint, inerse of a matrix and related problems

Define the addition and multiplication of matrices (of order m X n, with its different types in 3X3 order). Define a determinant and list the properties of a determinant. Define the inverse of a matrix.	Definition of a determinant, of a determinant's minor, cofactors and properties of determinants Application of matrix and determinant to solve linear system of equation (inverse of matrix and Carmer's Rule) Try only exercises XII (1), (2) and (3) No.1 to 10 from the textbook of grade XI
Evaluation methods: written assignments to solve related problems, written examination	**Teaching/Learning activities and resources:** Charts, models, graph boards, diagrams, classroom instruction, teacher led discussion, demonstration of solutions, illustration through and practical examples
1.6: Coordinate Geometry (Equation of a pair of lines)	**Hrs. theory 8**
Objectives	Contents
Define line pair equation or express two equations of straight lines as a single equation. Find the condition required for equation of second degree ($ax^2+2hxy+by^2+2gx+2fy+c=0$) to represent a pair of lines and fined the separate equations. Prove that the equation ($ax^2+2hxy+by^2=0$) always represents a pair of lines passing through the origin. Find the angle between two straight lines represented by the homogeneous equations of second degree ($ax^2+2hxy+by^2=0$)	Line pair equation, two equations of straight lines as a single equation. Condition required for equation of Second degree ($ax^2+2hxy+by^2+2gx+2fy+c=0$) to represent a pair of lines and alsofine the separate equations. Prove that the equation ($ax^2+2hxy+by^2=0$) always represents a pair of lines passing through the Origin. The angle between two straight lines represented by the homogeneous equations of second degree ($ax^2+2hxy+by^2=0$) Try only exercise XI No.1 to 10 from the textbook of grade XI.
Evaluation methods: written assignments to solve Related Problems, Written examination	**Teaching /Learning activities and resources:** Charts models graph boards, diagrams classroom instruction, teacher led discussion, demonstration of solution, illustration through practical example
1.7: limits and Values	**Hrs. theory 6**
Objectives	Contents
Define the term Limit and limiting values. Evalute the limiting values of simple algebraic & trigonometric Function. Use the formula $\lim_{x \to a} \frac{X^n - a^n}{X-a}$ $\lim_{x \to \theta} \frac{\sin\theta}{\theta} = 1$ (Without Proof) Define continuity and identify continous and discontinuous function	Limit and limiting values. Limiting values of simple algebraic & trigonometric Function. Using the formula $\lim_{x \to a} \frac{X^n - a^n}{X-a}$ $\lim_{x \to \theta} \frac{\sin\theta}{\theta} = 1$ (Without Proof) Define continuity and identify continous and discontinuous function Try only exercise XI No.1 to 5 of XVII (1) and (2)

Evaluation methods: written assignments to problems, written examination	**Teaching/Learning activities and resources:** Charts, models, graph boards, diagrams, classroom instruction, teacher led discussion, demonstration of solutions, illustration through practical examples
1.8: Derivatives and their applications (Maxima and Minima)	**Hrs theory 10**
Objectives	Contents
Define the terms derivatives. Apply definition to get derivates of the functions x^n,$(ax+b)^n$,sin(ax+b),cos(ax+b),e^x and logx. Use the sum, difference, product, quotient, and chain rule of derivatives to calculate the derivatives of algebric function only. Apply derivate to calculate maximum and minimum values of a given algebric function and other related problems.	Definition of the terms derivatives. Application of the definition to get derivatives of the functions x^n, $(ax+b)^n$, sin(ax+b),cos(ax+b), e^x and logx. Using the sum, difference, product, quotient, and chain rule of derivatives to calculate the derivatives of algebric function only. Application of derivate to calculate maximum and minimum values of a given algebric function and other related problems.(Exercises from the book of grade 11 or equivalent)
Evaluation methods: written assignments to solve related problems, written examination	**Teaching /learning activities and resources:** Charts, models, graph boards, diagrams classroom instruction, teacher led discussion, demonstration of solutions, illustration through practical examples.
1.9: Integration	**Hrs. theory 12**
Objectives	Contents
Define integral as antiderivative, Apply techniques of integration as anti derivate, substitution method, trigonometric substitution, integration by parts and definite integral. Use definite integral to calculate area enclosed by algebric curve, X-axis and ordinate at x=a to x=b.	Definition of integral as antiderivative, Application of techniques of integration as anti derivate, substitution method, trigonometric substitution, integration by parts and definite integral. Using definite integral to calculate area enclosed by algebric curve, X-axis and ordinate at x=a to x=b.
Evaluation methods: written assignments to solve related problems, written examination	**Teaching /learning activities and resources:** Charts, models, graph boards, diagram classroom instruction, teacher led discussion, demonstration of solutions, illustration through practical examples.
1.10: Probablity	**Hrs. theory 8**
Objectives	Contents
Define probability (classical and empirical) Prove and use addition and multiplication theorem of probability Explain and use binomial probability distribution formula $P(r) = c(n, r)\, p^r q^{n-r}$	Definition of probability (classical and empirical) Proof and use addition and multiplication theorem of probability Explanation and use binomial probability distribution formula $P(r) = c(n, r)\, p^r q^{n-r}$ Exercise XVII (1) and (2) No.1 to 5 only from textbook of grade 11.

Evaluation methods: written assignments written examination	**Teaching /Learning activities and resources:** Charts, models, graph boards, diagrams classroom instruction, teacher led discussion, demonstration of solution, illustration through practical examples.
1.11: Trigonometry	**Hrs Theory 5**
Objectives	Contents
Use practical applications of trigonometry.	Height and distance examples no.1 to 20 from textbook of intermediate trigonometry
Part B: Elementary Statistics	
Unit 2: Elementary Statistics	**Hrs theory 32**
2.1: Introduction to statistics (Revision only)	**Hrs theory 4**
Objectives	Contents
Define statistics as given by different writers (Prof. Horace Secrist, Prof. Croxton & Crowden and Prof. Ya-Lu-Chan). State the utility, functions and limitations of statistics.	Definition by Prof. Horace Secrist, Prof. Croxton & Crowden and Prof. Ya-Lu-Chan Utility, functions and limitation of statistics
Evaluation methods: Written, exams viva.	**Teaching/Learning activities and resources:** Classroom discussion, instruction, self-study, application of statistical methods textbook.
2.2: collection, classification and Tabulation diagrams and graphs (Revision only)	**Hrs theory 4**
Objectives	Contents
Collect data (primary and secondary) Classify and tabulate data Prepare frequency table (ungrouped and grouped form) Represent data on simple, multiple, Sub divided, percentage bar diagram and pie diagrams. Represent data on histogram, frequency polygon, frequency curve and ogive curve	Data collection (Primary and secondary) Classification and tabulation of data Preparation of frequency table (ungrouped and grouped form) Representation of data on simple, multiple, Sub divided, percentage bar diagram and pie diagrams Representation of data on histogram, frequency polygon, frequency curve and ogive curve
Evaluation methods: written exam viva.	**Teaching /learning activities and resources:** classroom discussion, self study, application of process to given examples textbook.
2.3: Central tendency	**Hrs theory 6**
Objectives	Contents
Define central tendency Calculate mean, median, mode, and partition values (Quartiles, Deciles and percentiles) for ungrouped and grouped data mathematically	Definition of central tendency Calculation of mean, median, mode, and partition values (Quartiles, Deciles and percentiles) for ungrouped and grouped data mathematically
Evaluation methods: written exam viva.	**Teaching /learning activities and resources:** classroom discussion, self study, application of process to given examples textbook.
2.4: Measure of dispersion	**Hrs theory 9**
Objectives	Contents

Calculate range, mean deviation from mean, median and mode, quartile deviation and standard deviation for ungrouped and grouped data mathematically Use Lorenz's curve to find the variability of two series Compute coefficient of range, mean deviation, quartile deviation, and variation for ungrouped and grouped data mathematically	Calculation of range, mean deviation from mean, median and mode, quartile deviation and standard deviation for ungrouped and grouped data mathematically Lorenz's curve to find the variability of two series Computation of coefficient of range, mean deviation, quartile deviation, and variation for ungrouped and grouped data mathematically
Evaluation methods: written exam viva.	**Teaching /learning activities and resources:** classroom discussion, self study, application of process to given examples textbook.
2.5: Correlation Coefficient	**Hrs theory 9**
Objectives	Contents
Define the concept of correlation. Define correlation method by drawing Scatter diagram Explain Karl Pearson's coefficient of correlation between two variables.	Concept of correlation. Method of studying correlation by drawing Scatter diagram Calculations of Karl Pearson's coefficient of correlation between two variables.
Evaluation methods: written exam viva.	**Teaching /learning activities and resources:** classroom discussion, self study, application of process to given examples textbook.

Mathematics and Statistics Practical

Course: Mathematics and Statistics Practical	Lab Hrs. 78
Practical 1: collection, Classification and Tabulation diagrams and graphs	**Hrs. practical 26**
Objectives	*Contents*
Prepare frequency tables (Individual, discrete and continuous) Draw simple subdivided, multiple and percentage bardiagrams Draw pie charts and pictograms Represent data on histograms, frequency polygons, Ogives	Classification and tabulation of data Presentation of data into simple bar diagrams, subdivided bardiagrams, multiple diagrams and percentage bar diagrams Presentation of data into Pie charts and pictograms Presentation of data into histograms frequency polygons and ogives
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.
Practical 2: Central tendency	**Hrs. practical 26**
Objectives	*Contents*
Calculate mean of individual and grouped data Calculate median mathematically and graphically Calculate quartiles, deciles and percentiles mathematically	Calculation of mean from individual and grouped data Calculation of median from individual and grouped data mathematically and graphically Calculation of quartiles, deciles and percentiles
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.

Practical 3: Measure of dispersion	**Hrs. practical 26**
Objectives	*Contents*
Calculate mean deviation from central values Calculate standard deviation of individual and grouped data Find the coefficient of variation	Calculation of mean deviation from mean and median Calculation of standard deviation from individual and grouped data through shortcut method and direct method Calculation of coefficient of variation
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.

Computer Application

Total: 156 hrs **Full Marks: 100**
Theory: 78 hrs
Practical: 78 hrs

Course Description

This course provides basic knowledge on Computer application in forest sciences. This course intends to literate students in the arena of computer education and GIS science. Course is intended to give knowledge on hardware requirements of computer, Operating Systems, Word processing, spreadsheet and database, presentation, graphic and multimedia, Web, Email and Internet, Virus and anti-virus definitions, and its application.

Course Objectives

- Gain knowledge and skills on computer application and Able to prepare word documents
- Able to do preliminary calculations and analysis in spreadsheet
- Able to prepare graphics and presentation slides

Recommended Texts

- Computer Science-7,Dipak Pudasaini
- Computer concept by RC Khanal
- Basic Computer Concepts; Seema Sirpal, Delhi University Computer Center
- Basic Computer Course; CS Changeriya, Chetan Prakashan
- Introduction to Computer Science: A text book for beginners in informatics- Gilbert Brands
- Cloud Computing: From Beginning to End, 2015 by Mr. Ray J Rafaels (Author)
- Competitive Programmer's Handbook Antti Laaksonen Draft July 3, 2018

Course Contents

Course: Basic Computer application for forestry	**Hrs. theory 78 Hrs. Practical 78**
Unit 1: Introduction to computer	**Hrs. theory 12**
Objectives	**Content**
Explain about the generation of computers. List hardware and peripherals of computer List the available software in general use. Write about memory and data storage in computer Discuss about operating system in computer	• Introduction of computers • Generation of computers • Hardware: CPU, Monitor, Input and output peripherals • Software: systems, applications and utility software • Memory: RAM, ROM, storage systems, storage types and Data storage • Operating Systems: DOS, Windows, Linux, Nepalinux • Terminologies
Evaluation methods: Oral and written test, home assignments, interaction at class, project, seminar	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 2: Word Processing	**Hrs. theory 11**
Objectives	**Content**
Create word document in computer. Format the document	• Document creation • Formatting, proof reading, editing

Edit the document Print the final document	• Typing Tutor • Saving and opening • Printing
Evaluation methods: Oral and written test, home assignments, interaction at class, project, seminar	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 3: Spreadsheet	**Hrs. theory 15**
Objectives	**Content**
Prepare a schema of data tabulation Enter data in spreadsheet Format the excel sheet Do calculation using formula in spreadsheet Prepare charts based on entered data	• Data tabulation • Data entry • Pivot Table • Formatting, editing, charting calculations, formulas • Saving and opening • Presentation and printing
Evaluation methods: Oral and written test, home assignments, interaction at class, project, seminar	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 4: Presentation and Graphics	**Hrs. theory 15**
Objectives	**Content**
Prepare slides for presentation Apply different design schemes in slides Apply different animations for the objects Edit the slides Go to slide show	• Slide preparation • Design, multimedia, proofreading, editing • Saving and Opening • Presentation and printing
Evaluation methods: Oral and written test, home assignments, interaction at class, project, seminar	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 5: Email, Internet, Virus protection	**Hrs. theory 5**
Objectives	**Content**
Explain about Email Explain about Internet Explain about website Explain about virus and anti-virus system	System of Email Internet, URL, WWW, http Virus and virus protection mechanism: Norton, ESET and Kaspersky
Evaluation methods: Oral and written test, home assignments, interaction at class, project, seminar	**Teaching/Learning activities and resources**: classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 6: Cloud computing	**Hrs. theory 8**
Objectives	**Content**
Explain about cloud computing and its utilities in NRM To know about advantages of cloud computing	Introduction What is Cloud? What is Cloud Computing? Cloud Computing Architecture Advantages of Cloud Computing Cloud Storage: box, Skydrive, amazon, Dropbox etc.
Evaluation methods: Oral and written test, home assignments, interaction at class, project, seminar	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 7: Programming	**Hrs. theory 12**
Objectives	**Content**

Learn the basic of programming Explain about the Computer Language Explain about the programming language Generate ideas on problem solving through programming	Concept of programming Computer language Programming language Methods of programming Problem Solving
Evaluation methods: Oral and written test, home assignments, interaction at class, project, seminar	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books

Computer Application, Practical:

Course: Computer Practical	**Lab Hrs 78**
Practical 1: Typing Tutor	**Hrs 7**
Objective	**Content**
Complete typing tutor	Type English Fonts Type Nepali Fonts
Practical 2: Work on MS word	**Hrs 10**
Objective	**Content**
Carry hands on Microsoft Word	Document creation Document formatting Document saving Document editing Document printing
Practical 3: Work on MS Excel	**Hrs 16**
Objective	**Content**
Carry tutorials on MS Excel	Data entry in spreadsheet Data analysis Graphical presentation of data Tabulation and Printing
Practical 4: Work on MS Powerpoint	**Hrs 15**
Objective	**Content**
Carry tutorials on Power point	Slide preparation Design, multimedia, proofreading, editing Saving and Opening Presentation and printing
Practical 5: Work on Email, Internet and Virus	**Hrs 10**
Objective	**Content**
Carry tutorials on browsing Internet and Email and virus	Browsing Internet on Safe mode Bookmark the useful link Opening new emails Explore some of freely available antivirus
Practical 6: Work on Cloud	**Hrs 10**
Objective	**Content**
Carry tutorials on Cloud Computing	Download a cloud based apps on computer Handle Dropbox and Google Drive
Practical 7: Programming	**Hrs 10**
Objective	**Content**
Carry tutorials on ideas of programming	Illustrations of top programming languages Demonstrations of solving problems by using Python

Second Year

1. **Silviculture**
2. **Wildlife and Protected Area Management**
3. **Soil and Water Conservation Management**
4. **Community Forestry**
5. **Forest Measurement**
6. **Non- Timber Forest Products (NTFPs)**
7. **Forest Harvesting and Utilization**
8. **Agroforestry**

Silviculture

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

Course Description
This course provides basic knowledge in Silviculture including the common terms in Silviculture, importance of locality factors, concepts of succession, causes of succession and concept of climax, ecological basis of forest types classification, forest classification on the basis of management objectives and ownership, application of silvicultural systems in forest management, silviculture of selected species, natural forests and manmade forests, seed year, time of seed production, method of seed collection, suitable species for different land use practice, nursery management practices, plantation techniques, management and tending operation.

Course Objectives
This Course has the following Objectives:

- explain the importance of Silviculture
- work in the national and private forestry sectors
- describe basic Silviculture and ecology of some important forest species of Nepal
- demonstrate general knowledge of natural regeneration and man made forests
- apply technical skills in thinning, pruning and other plantation tending techniques

Text and Reference books

1. Manual on Reforestation Techniques, R.C Ghosh
2. Manual on Afforestation in Nepal, J,K Jackson-Volume-I
3. Principles and Practice of Silviculture, L.S Khanna.
4. Silvics of Trees of Nepal, Baban Prasad Kayastha.
5. Handbook of Silviculture, Champion and Trevor.
6. Manual of Afforestation in Nepal, J.K Jackson.Volume -II
7. Forest Act of Nepal 1993, DoF, GoN.

Course Contents

Course: Silviculture	**Hrs. theory 117 Hrs. Practical 78**
Unit 1: Introduction to Silviculture	**Hrs theory 5**
Objectives	Contents
Define Silviculture and objectives of the Silviculture	• Definition of Silviculture and silvics • Main Objectives of Silviculture • Specific Objectives of Silviculture • Relation of Silviculture with forestry and its branches
Evaluation Methods: Oral and written tests, home assignment, participatory class interaction	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 2: Locality Factors	**Hrs theory 12**
Objectives	Contents
Define locality factors and explain its different types and its importance	• Definition of locality factors Its importance and classification into four broad categories • Climatic factors

	• Topographical factors • Edaphic factors • Biotic factors
Evaluation Methods: Oral and written test, home assignment, participatory class interaction	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 3: Concept of plant succession	**Hrs Theory 7**
Objectives	Contents
Define plant succession and explain the concept of succession, its different types, causes of succession and concept of climax vegetation	• Description and evolution of concept of the plant succession • Kinds of succession (Primary, Secondary) • Causes of succession • Concept of climax • Classification of climax
Evaluation Methods: Oral and written test, home assignment, participation, interaction in class	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 4: Forest Type Classification on Ecological Basis	**Hrs Theory 7**
Objectives	Contents
Explain the basis of forest type classification and the features of various forest types classified on ecological basis.	• Definition of forest type • Objective of classification of forest into forest types • Basis of forest type classification • Forest Types of Nepal
Evaluation Methods: Oral and written test, homw assignment,participation, class interaction	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 5: Forest classification on the basis of management objectives and ownership	**Hrs Theory 7**
Objectives	Contents
Explain forest classification on the basis of management objectives and ownership	<u>On the basis of management objectives</u> • Production forest • Protection forest • Protected areas On the basis of ownership, <u>National Forest,</u> ➢ Government managed forest ➢ Community Forest ➢ Leasehold Forest ➢ Collaborative Forest ➢ Religious forest ➢ Protected Forest ➢ Private Forest
Evaluation Methods: Oral and written test, assignment, participation and interaction in class	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.

Unit 6: Silvicultural System	**Hrs Theory 7**
Objectives	Contents
Define silvicultural systems and explain its various types and application	Definition of silvicultural system Classification of silvicultural systems Definitions, characteristics,advantages and disadvantages of following silvicultural systems • Clear felling system • Shelter wood system • Selection system • Coppice system
Evaluation Methods: Oral and written test, home assignment, class interaction	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 7: Silviculture of selected species	**Hrs theory 15**
Objectives	Contents
Explain natural distribution, silvicultural characteristics, field identification, methods of propagation and uses of selected spceies	Indigenous species: Sal, Sissoo, Khair, Simal, Katus, Chilaune, Utis, Champ, Bakaino,Pines (Chir and Blue), deodar and Loth salla, Fodder: Badahar, Nimaro, Khanyu, Tanki Exotic species: Eucalyptus, Teak, Popular
Evaluation Methods: Oral and written test, home assignment, interaction	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 8: Natural and Manmade forest	**Hrs Theory 10**
Objectives	Contents
Define natural forest and man -made forest and also explain the factors affecting natural regeneration, the methods of natural regeneration and importance of natural and artificial regeneration	Definition of regeneration Natural Regeneration, Artificial regeneration (afforestation & reforestation) Factors affecting natural regeneration, Importance of natural and artificial regeneration, Plantation activities in Nepal
Evaluation Methods: Oral and written test, home assignment. Class interaction	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 9: Seed Production	**Hrs Theory 9**
Objectives	Contents
Discuss the importance of seed production and explain the methods of seed collection, seed extraction and seed storage	Seed year Germination capacity Germinative energy Plant percent, viability, Time of seed collection, Methods of seed collection, Seed extraction and storage,viability
Evaluation Methods: Oral and written test, home assignment, class interaction	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 10: Choice of species for reforestation/afforestation	**Hrs theory 9**
Objectives	Contents

List the suitable species for different land use practice	Denuded hill Abandoned cultivated lands Grasslands Ravine lands Road and canal sides Farm forestry Water logged areas Large commercial plantation
Evaluation Methods: Oral and written test, home assignment. Class interaction	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 11: Nursery practices	**Hrs Theory 11**
Objectives	Contents
Define nursery and its types and Explain the criteria for selection of nursery sites, techniques of nursery construction and bed preparation ,seed treatmenttechniques of seedling production, and management	Nursery Types of nursery (Temporary and permanent) Criteria for nursery site selection Nursery construction Seed beds preparation (Sunken and Raised) Seed treatment Seedling production (Container, bare, stumps) Protection and maintenance of seedlings Seed sowing Manuring/fertilization Nursery equipment/tools
Evaluation Methods: Oral and written test, home assignment, class interaction	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 12: Plantation	**Hrs Theory 6**
Objectives	Contents
Define plantation, appraise the plantation sites and describe the techniques of ground /land preparation, pitting, spacing and planting, they will also be able to differentiate between planting and direct showing.	Appraisal of planting sites (slope, aspect, exposure, vegetation, soil) Protection of planting sites (fencing, hedges, walls) Ground preparation (manual, mechanical, chemical) Spacing and pitting Use of appropriate tools Care to be taken in handling seedlings Plantation versus direct sowing
Evaluation Methods: Oral and written test, home assignment, class interaction	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 13: Plantation management and tending operations	**Hrs. theory 12**
Objectives	Contents
Define plantation management and tending operations and also able to explain intercropping practices in Nepal	Plantation management Importance of tending operation in plantation forest Weeding and cleaning Assessment and replacement of losses Thinning and pruning Intercropping (Taungya)

Evaluation Methods: Oral and written test, home assignment, class interaction	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.

Silviculture Practicals

Silviculture Practical	**Hrs Practical 78**
Practical 1: Forest types	**Hrs 16**
Objectives	Contents
• Identity the different forest types • Identity the species composition in different forest types	Visit to Terai and hill forest
Practical 2: Excursion and plant identification	**Hrs 16**
Objectives	Contents
• Identity the plant species in a community forest	Visit to a community forest
Practical 3: Nursery Techniques	**Hrs 20**
Objectives	Contents
• Construct a forest nursery • Prepare cutting • Prepare nursery beds • Demonstrate the practice of soil mixing, container filling and seed sowing • Estimate cost for seedling production	Nursery materials Nursery layouts Nursery bed preparation Preparation of detail cost estimate for producing 1,00,000 seedlings in already prepared nursery beds.
Practical 4: Seed Science	**Hrs 12**
Objectives	Contents
• Demonstrate the seed collection, extraction and storage techniques • Evaluate the seed germination capacity	Seeds, seed collection Seed extraction and storage techniques Seed germination and viability
Practical 5: Tending operation	**Hrs 14**
Objectives	Contents
• Demonstrate cleaning, thinning, singling and pruning practices	Harvesting tools Harvesting tools, harvesting techniques

Wildlife and Protected Area Management

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

Course Description
This course provides basic knowledge about wildlife management and concepts of eco-tourism. This course is divided into nine units. The first unit gives general introduction of wildlife and definition of technical terms. The second unit deals with the brief ecological description of some important wildlife. The third unit describe about the legal status of wildlife and the values of wildlife. The fourth unit describes about the concept of population dynamics of wildlife and the techniques to estimate wildlife population. The fifth unit deals with the system of protected area management, its present scenario in Nepal and buffer zone management. This sixth unit provides information on human dimension of wildlife management. The seventh unit gives details about recreation management. The eighth unit teaches about tourism and its impacts. The ninth unit discuses about the attraction and services in tourism.

Course Objectives
This Course has the following objectives

- Wildlife management
- Recreation management with ecological consideration
- Definition of important technical terms
- Needs for wildlife conservation
- Present status and ecology (feeding and reproductive) of some important mammals, birds, reptiles, insects, and amphibians.
- Values and legal status of wildlife
- Basic concepts of population dynamics and techniques of population estimation
- Protected area of Nepal and their role
- Park-People relationship, buffer zone management
- Management activities related to the development of recreational areas
- Ecological consideration in expanding tourism
- Tourist management and regulation
- Integration of biological and social criteria in recreation management
- Introduction to International conventions and agreements (CBD, Ramsar Convention, CITES, World Heritage Convention etc.),
- Trans-boundary Coordination

Recommended Texts and Reference Books

- Collier, A. (1989). Principles of Tourism. Pitman, New Zealand.
- Dashmann, R. F. 1964. Wildlife Biology. Rep (2011). New Delhi, India.
- DNPWC. 2069. Pratibandhit tatha sanrackchhit banyajantu tatha aakhetopahar ra pahichan pustika. Department of National Parks and Wildlife Conservation, Kathmandu, Nepal. (In Nepali).
- Ghimire, A. 2007. Travel and Tourism. Third (Revised and Updated) Edition. Ekta Books Distributors, Pvt. Ltd. Kathmandu, Nepal.
- Lakhey, S. P. 2014. Wildlife Biology. Institute of Forestry, Hetauda Campus. Nepal.
- Menon, V. 2014. Indian Mammals: A Field Guide. Wildlife Trust of India, India.
- Mill, R. C. and A. M. Morrison. 1985. The Tourism System: An Introductory Text. Prentice-Hall Inc., N. J., U. S. A.

- Prater, S. H. 1971. The Book of Indian Mammals. Third (Revised) Edition Rep 16 . Bombay Natural History Society. Bombay Society and Oxford University Press, India.
- RECOFTC. .Ecotourism for Forest Conservation and Community Development, RECOFTC, Nepal.
- Shaw, J. H. 1985. Introduction to Wildlife Management. McGraw Hill Inc, New York, U.S.A.
- Singh, S. K. 2005. Text Book of Wildlife Management Techniques. International Book Distributing Co., Charbagh, Lucknow, India.
- Uprety, B.N. 2017. Early Days of conservation in Nepal: a collection of papers and views since 1970. Nepal Biodiversity Society NEBORS, Kathmandu, Nepal.

Course Contents

Course: Wildlife and protected area Management	***Hrs. theory 117 Hrs. Practical 78***
Unit 1: Introduction	**Hrs. theory 6**
Wildlife management	*Hrs. theory 6*
Objectives	**Contents**
Define different terminologies used in wildlife management	• Conservation, Management, Protection, endangered species, habitat, niche, food and cover, home ranges and territory, dispersion and migration, edge and eco-tone, liter, clutch, eco-trail, heritage, carrying capacity • Use of animal parts: Medicinal, aromatic and animal parts • Identification of trophy and samples
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Habitat Management	Forest, Water, Grassland,
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 2: Brief ecology of some important wildlife (Mammals, Birds, , Amphibians, Insects)	**Hrs. theory 20**
2.1 Mammals	***Hrs. theory 6***
Objectives	Contents
Explain the ecological characteristics of Mammals	• Musk deer, **Black buck** • Tiger, Leopard cat, Wild dog, Brown bear • Blue sheep • Dolphin • Big mammals: Rhino, Elephant, Arna
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
2.2 Birds	***Hrs. theory 4***
Objectives	Contents
Explain about the brief ecological characteristics of birds	• Pheasants (Danphe), storks (Black Stork), floricans (Khar Mujur), crane (Sarus), giant hornbill (Raj Dhanesh)

Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
2.3 Reptiles	***Hrs. theory 4***
Objectives	Contents
Explain the ecological characteristics of reptiles	• Python, crocodiles (Gharial), golden monitor lizard
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
2.4 Insects	**Hrs theory 3**
Objectives	Contents
Explain the ecological characteristics of insects	• Termite, Bee, Butterfly
Evaluation methods: oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, text book, reference books
2.5 Amphibians	**Hrs theory 3**
Objectives	Contents
Explain the ecological characteristics of Amphibians	Toad, *Rana tigerina (*frog)
Evaluation methods: oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, text book, reference books
Unit 3: Wildlife values and Legal status of wildlife	**Hrs. theory 12**
3.1 Wildlife values	***Hrs. theory 5***
Objectives	Contents
Elaborate the value of wildlife Describe about different values of wildlife i.e. Positive , Direct and Indirect, Consumptive and non-consumptive	• Positive values: Consumptive and non-consumptive values • Wildlife depredation, and damage.
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
3.2 Legal status of wildlife in Nepal	***Hrs. theory 7***
Objectives	Contents
Explain the policies formulated in Nepal in wildlife management and nature conservation 3 Introduction to international conventions and agreements Explain international conventions and agreements	Brief history of wildlife conservation in Nepal Concept of National Park and Wildlife Conservation Act, CITES related Act, Rules and Regulations: • Buffer zone Management Rules and Guidelines • International and national organization working in nature and wildlife conservation: CITES, , Ramsar convention, UNESCO

Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 4: Wildlife population	**Hrs. theory 14**
4.1 Population dynamics	***Hrs. theory 6***
Objectives	Contents
Overview the different parameters of population dynamics	• Fatality and Mortality • Age structure, Sex ratio • Migration (immigration and emigration) • Population growth (population growth curves, types of population change curves
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
4.2 Population estimation techniques	***Hrs. theory 8***
Objectives	Content
List the methods of wildlife population estimation Explain the different methods of wildlife population 3 Wildlife capture and translocation Explain wildlife capture and translocation	• Mark and recapture technique • Transect surveys • Pellet-group counts • Roadside counts • Antler counts (Cervids) • Call and nest counts (birds) Introduction to wildlife capture, translocation and camera trapping
Evaluation methods: Oral and written test, home assignment	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 5: Protected Area Management	**Hrs. theory 21**
5.1 Introduction/Concept	**Hrs. theory 3**
Objectives	Contents
Explain about the practice of national park and wildlife management in Nepal	• National Parks and Wildlife reserves • Buffer zone • Hunting reserve • Conservation area • Protected areas of Nepal and their significance
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
5.2 Park management	**Hrs. theory 7**
Objectives	Contents
Explain Park management systems	• Policies • Prohibition and exploitation • Research • Administration • Law enforcement • Zoning • Conservation education

	• Visitor center/Information center management
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
5.3 Buffer-zone management	**Hrs. theory 5**
Objectives	Contents
Define buffer-zone management and acquired skills on practice of buffer zone management	• Definition of buffer zone • Importance of buffer zone • Buffer zone management techniques • Park-people conflict and its management • People's participation for conservation • Anti-poaching
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
5.4 Eco-tourism management	**Hrs. theory 6**
Objectives	Contents
Define different terms used in tourism management	• Travel and tourism, eco-tourism • Dimensions of travel • Growth of world tourism • History and growth of tourism in Nepal • Types of tourists
Unit 6: Human Dimension	**Hrs. theory 6**
Objectives	Contents
Explain the different perspective of wildlife management in human dimension domain	• Introduction • Legal, economic and social perspective • Major issues in wildlife conservation in Nepal • Building relationship between park and people and improving coordination
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 7: Recreation Management	**Hrs. theory 14**
7.1 Recreation in natural resource environment	**Hrs. theory 6**
Objectives	Contents
Define recreation management Provide details of different packages for recreation management	• Principles of eco-tourism • Motivation for environmental tourism • Backpacking and hiking, Camping • Rafting, fishing, hunting, bird-watching, jungle walk • Canoeing, Kayaking, elephant riding, horse riding • Limitations of eco-tourism
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books

7.2 Visitor Management	**Hrs. theory 4**
Objectives	Contents
List the activities for the support of visitors	• Visitor activities • Radio communication • Visitor center • Information display • Sign posts (signage arrow)
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
7.3 Resource management and staff accommodation	**Hrs. theory 4**
Objectives	Contents
Explain the community development in/around the tourism Explain the staff management and community awareness	• Trail construction and facility • Garbage disposal road layouts • Bridge construction and facility developments • Staff accommodation • Community awareness
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 8: Tourism and its impact	**Hrs. theory 14**
8.1 Tourism regulation	**Hrs. theory 4**
Objectives	Contents
Describe the tourism regulations	• Introduction to tourism legislation and regulations
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
8.2 Impacts of tourism	**Hrs. theory 10**
Objectives	Contents
Explain about the impacts of tourism	• Positive and negative: • Economic impacts of tourism ,Socio - cultural impacts of tourism • Environmental impacts of tourism
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 9: Attraction and Services	**Hrs. theory 10**
9.1 Attraction	**Hrs. theory 5**
Objectives	Contents
Define attraction factor in tourism and recreation management Explain the types of attraction	• Definition, factors of attraction in tourism and recreation management • Types of attraction: Natural,Manmade and Socio-cultural
9.2 Facilities and Services	**Hrs. theory 5**
Objectives	Contents

The facilities and services to provide to visitors	• Accommodation • Accessibility (Transportation) • Visitor Information center • First-aid and Hospitals • Park, rest places • Other facilities and services
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books

Wildlife and Protected Area Management Practical:

Course: Wildlife and Protected Area Management Practicals	**Practical Hrs: 78**
Practical 1: Identification of animals/their specimen	**Practical Hrs: 6**
Objectives	*Contents*
Identify animal parts and specimens	Identification of Tibetan antelope (chiru) sahatus wool and Pasmina wool
Practical 2: Identification of antlers and pellets	**Practical Hrs: 6**
Objectives	*Contents*
Identify animal parts and specimen	Identification of antlers and pellets
Practical 3: Identification of Rhino horn and fake horn, skull of tiger and leopard and other canids/felids	**Practical Hrs: 16**
Objectives	*Contents*
Identify animal parts and specimen	Identification of Rhino horn and fake horn, skull of tiger and leopard and other canids/felids
Practical 4: Sexing Jaw identification	**Practical Hrs: 15**
Objectives	*Contents*
Identify animal parts and specimen	Sexing Jaw identification
Practical 5: Population estimation in fields (Transect survey, road side count, Pellet-group counts, Antler count, Call and Nest count).	**Practical Hrs: 20**
Objectives	*Contents*
Conduct wild animal census	Population estimation in fields (Transect survey, road side count, Pellet-group counts, Antler count, Call and Nest count).
Practical 6: Preservation of collected specimens	**Practical Hrs: 15**
Objectives	*Contents*
Preserve collected specimens	Preservation of wildlife specimens

Soil and Water Conservation Management

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

COURSE DESCRIPTION

This course combines introductory soil science with Soil and Water Conservation Management. The first part provides fundamental knowledge and skills in soil science including physical and biological properties of soil, introduction to problematic soils, factors of soil formation, soil and organic matter and introduction of forest soil of Nepal. The second part gives fundamental concepts of soil and water conservation. The main contents of the course include hydrology, soil erosion and its consequences, soil conservation measures, land-use planning and the principles of watershed management.

COURSE OBJECTIVES

In general, students learn the fundamental concepts and principles of soil and water conservation practices in Nepal. Specifically, at the end of the course, the students will be able to:

- understand the importance of soil and study of soil science
- demonstrate the understanding of the basic physical and biological properties of soils in the field
- identify and collect representative soils sample/pit sites
- describe soil profile and evaluate its significance for basic land management,
- evaluate the long-term sustainability of soils,
- understand the principles of soil and water conservation,
- know the different types of erosion and their consequences,
- define watershed and describe the watershed components,
- identify the various kinds of erosion and analyse the factors contributing to soil erosion
- explain the use of soil and maintaining its productive capacity

Recommended Texts:

- Nature and Property of Soils, Brady
- Soil conservation, Norman Hodson
- Watershed Planning Manual Sthapit K.M
- Soil Conservation and Watershed Management, the Nepal Australia Community Resource Management Project

Course Contents

Course: Soil and Water Conservation Management (Theory hrs. 117 , Practical hrs. 78)	
UNIT 1: Introductory Soil Science	**Theory hrs: 4**
1.1: Concept of soil and soil profile	Theory hrs: 2
Objectives	***Contents***
• Explain the fundamental concept of soil. • Explain the different layers of the soil	• Concept of soil • Difference between forest soil and agricultural soil • Soil Profile • Definition of soil
Evaluation methods: oral and written tests and home assignments	Teaching / learning activities & resources*:* classroom instruction, illustrations, diagrams, visuals textbooks and reference books
1.2: Soil Ecology	**Theory hrs: 2**
Objectives	***Contents***
• Define soil ecology – what does it mean • What are biotic and abiotic factors in soil ecosystem? • Provide examples of biotic and abiotic factors	Biotic and abiotic factors
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 2: Physical and Chemical Properties of Soil	**Theory hrs : 32**
2.1: Physical and Chemical Properties of Soil	**Theory hrs: 16**
Objectives	***Contents***
• Explain the fundamental concept of soil.	• Soil depth, Soil texture, Soil structure, Soil porosity,Soil density • Soil pH, Soil color, Soil consistency
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
2.2: Percolation and infiltration	**Theory hrs: 2**
Objectives	***Contents***
• Explain percolation and infiltration and differentiate between the two.	• Percolation and infiltration • Difference between percolation and infiltration
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
2.3: Role of microorganisms in the soil	**Theory hrs: 4**
Objectives	***Contents***
• Explain roles of microorganisms in the soil.	• Role of microorganisms in the soil
Evaluation methods: oral and written tests and home assignment	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books

2.4: Soil/plant relationship in the context of physical and biological properties	**Theory hrs: 10**
Objectives	***Contents***
• Explain the soil/plant relationship in the context of physical and biological properties.	• Soil/plant relationship in the context of physical and biological properties.
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 3: Introduction to Problematic soils	**Theory hrs: 7**
3.1: Problematic soils	**Theory hrs: 3**
Objectives	***Contents***
• Explain the features of problematic soils.	• Landslides, Waterlogged • Acidic, alkaline, saline • Low fertility/highly eroded
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
3.2: Method of improving problematic soils	**Theory hrs: 4**
Objectives	***Contents***
• Explain the method of improving problematic soils.	• Method of improving problematic soils
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 4: Factors of Soil Formation	**Theory hrs: 6**
Objectives	***Contents***
• List and explain the factors of soil formation.	• Climate-*Weathering process (Physical, Chemical &, Biological Weathering)* • Living organisms • Relics • Parent material • Time
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 5: Soil and Organic Matter	**Theory hrs: 4**
Objectives	***Contents***
• Explain the contribution of organic matter to soil fertility and structure. • Explain the relationship between organic matter and microorganisms.	• Contribution of organic matter to soil fertility and structure • The relationship between organic matter and microorganisms
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 6: Introduction of Forest Soils of Nepal	**Theory hrs: 5**
Objectives	***Contents***
• List major forest soil types of Nepal.	• Major forest soil types of Nepal

• Explain effects of forest or vegetation forest types on soil. • Explain the soil condition in different land uses.	• Effects of Forest vegetation or forest types on soil • Soil condition in different land uses
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 7: Concept and principles of soil and water conservation management	**Theory hrs: 6**
7.1: Definition & basic principles of soil and water conservation	**Theory hrs: 3**
Objectives	***Contents***
• Understand the concept of soil and water conservation • Why do we need to conserve the soil and water	• Concept of soil conservation, water conservation • Importance of soil and water conservation
Evaluation methods: oral and written tests and home assignment	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
7.2: Watershed Management	**Theory hrs: 3**
Objectives	***Contents***
• Explain the concept of WM. • Explain the efforts made for WM in Nepal.	• Definitions of the terms watershed/sub-watershed and watershed boundary • Characteristics of watershed (climatic, physiographic etc.) • Objectives & categories of watershed management • Integrated /watershed management efforts in Nepal
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 8: Introduction to Hydrology	**Theory hrs: 8**
8.1: Basic concept of hydrology	**Theory hrs: 4**
Objectives	***Contents***
• Define the basic terms of hydrology. • Explain the hydrological cycle.	• Definitions of terms (Hydrology, Precipitation & Infiltration) • Hydrological cycle
Evaluation methods: oral and written tests and home assignment	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
8.2: Measurement of discharge	**Theory hrs: 4**
Objectives	***Contents***
• Explain the measurement of precipitation, infiltration and discharge by simple method. • Importance of discharge measurement	• Measurement of precipitation & infiltration • Surface run off, types of streams& measurement of discharge by simple method

Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 9: Soil Erosion and its Consequences	**Theory hrs: 14**
9.1: Concept of Soil Erosion	**Theory hrs: 7**
Objectives	***Contents***
• Define soil erosion and explain about its types. • Explain the causes of soil erosion.	• Definition of soil erosion • Types of soil erosion • Causes of soil erosion
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
9.2: Factors affecting soil erosion	**Theory hrs: 3**
Objectives	***Contents***
• Explain the factors affecting soil erosion.	• Major factors affecting soil erosion
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
9.3: Consequences of erosion	**Theory hrs: 4**
Objectives	***Contents***
• Explain the consequences of soil erosion.	• Gully formation • Landslides • Damage caused by soil erosion Siltation of lakes
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 10: Soil Conservation Measures	**Theory hrs: 14**
Sub unit 10.1: Physical/Engineering Measures	**Theory hrs: 5**
Objectives	***Contents***
• Explain basic physical and engineering measures of soil conservation • Design check-dam, retaining wall, diversion cannel, terraces, and embankment. • Supervise construction of check-dam, retaining wall, diversion cannel, terraces & embankment.	• Physical measure of soil conservation • Basic concept of: check-dam, retaining wall, diversion cannel, terraces, embankment
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
10.2: Biological Measures	**Theory hrs: 4**
Objectives	***Contents***
• Explain the significance and the basic biological measures of soil conservation • Able to design biological measures of soil conservation. • Supervise construction of biological measures of soil conservation	• Plantation and seeding • Manure, fertilization and mulching • Control of grazing/rotational grazing • Cropping pattern

Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
10.3: Combination of Engineering and Biological Measures	**Theory hrs: 3**
Objectives	***Contents***
• Explain combination of engineering and biological measures of soil conservation.	• Combination of engineering and biological measures
Evaluation methods: oral and written tests and home assignment	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
10.4: Extension Programs for Soil and Water Conservation	**Theory hrs: 2**
Objectives	***Contents***
• Explain tools and techniques for extension need of soil conservation.	• Need and importance of extension of soil conservation • Tools and techniques for extension
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 11: System Approach to Watershed Management	**Theory hrs: 9**
Sub unit 11.1: Rehabilitation	**Theory hrs: 2**
Objectives	***Contents***
• Explain the rehabilitation process and measures of the degraded watershed area.	• Rehabilitation process and measures of the degraded watershed area
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
11.2: Conservation education and extension	**Theory hrs: 2**
Objectives	***Contents***
• Explain the tools and techniques of conservation education need of soil conservation.	• Need and impotence of conservation education in soil conservation • Tools and techniques of conservation education
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
11.3: Preventive Measures	**Theory hrs: 2**
Objectives	***Contents***
• List the preventive measures of soil conservation in the watershed area. • Apply the preventive measures for soil conservation in the watershed area.	• Preventive measures of soil conservation in the watershed / sub-watershed area
Evaluation methods: oral and written tests and home assignment	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
11.4: Participatory approach to watershed management	***Theory hrs: 3***
Objectives	***Contents***

• Define Participatory approaches to watershed management • List Community Development Plan preparation, implementation and monitoring and evaluation process and practices	• Definition of participatory approaches to watershed management • Community Development Plan preparation implementation and monitoring and evaluation process and practices
Evaluation methods: *oral and written tests and home assignments*	***Teaching / learning activities & resources:*** *classroom instruction, illustrations, diagrams, visuals textbooks and reference books*
UNIT 12: Land Evaluation and Land Use Planning	**Theory hrs.: 8**
12.1: Land Evaluation	**Theory hrs: 3**
Objectives	***Contents***

• Explain land evaluation process and techniques.
• Perform land evaluation of the particular land.
	• Land evaluation
	  ○ Effective depth
	  ○ Texture
	  ○ Permeability
	  ○ Slope
	  ○ Soil reaction,
	  ○ Color
	  ○ Parent material
	  ○ Natural vegetation
	  ○ Available moisture capacity

Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
12.2: Land use and Land Capability Classification	**Theory hrs: 5**
Objectives	***Contents***
• Explain the concept of land cover, land use and land capability classification. • Explain the difference of land cover and land use. • Explain the different system of land capability classification.	• Concept of land cover land use and land capability classification • Difference between land cover and land use • National / International system of Land capability classification
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books

Soil and Water Conservation Management Practical

COURSE: Soil and Water Conservation Management	**Practical hrs. : 78**
Practical 1: Familiarization of profile descriptions	**Practical hrs: 6**
Objectives	***Contents***
• Be acquainted with soil profiles.	• Field visit and observation of soil profile at different sites

Evaluation methods: oral and written tests evaluation of work activities	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.
Practical 2: Textural and color identification	**Practical hrs: 6**
Objectives	***Contents***
• Identify the soil texture and soil color in the field.	• Field visit and observation of soil texture and soil in the field at different sites
Evaluation methods: oral and written tests evaluation of activities	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.
Practical 3: Collection of Soil Samples	**Practical hrs: 6**
Objectives	***Contents***
• Collect soil samples successfully.	• Field visit and collection soil samples from different sites
Evaluation methods: oral and written tests evaluation of activities	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.
Practical 4: Identification of problematic soils	**Practical hrs: 6**
Objectives	***Contents***
• Identify problematic soils successfully.	• Field visit and identification of problematic soils from different sites
Evaluation methods: oral and written tests evaluation of activities	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.
Practical 5: Vegetative Measures for Soil Conservation	**Practical hrs: 13**
Objectives	***Contents***
• Visit places of vegetative measures for soil conservation. • Prepare a sample vegetative measures for soil conservation	• Field visit to study exiting measures for soil conservation • Preparation of a sample vegetative measures for soil conservation
Evaluation methods: oral and written tests evaluation of activities	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.
Practical 6: Engineering/ Mechanical Methods for Soil Conservation	**Practical hrs: 10**
Objectives	***Contents***
• Be acquainted with engineering/ mechanical methods for soil conservation.	• Field visits to the places of engineering / mechanical methods for soil conservation study exiting vegetative measures for soil conservation • Study of the significance of engineering / mechanical methods for soil conservation
Evaluation methods: oral and written tests evaluation of activities	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.
Practical 7: Slope Measurement	**Practical hrs: 6**
Objectives	***Contents***

• Measure slopes in the field.	• Field visits the measurement the slope of land of various conditions.
Evaluation methods: oral and written tests and evaluation of work activities.	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.
Practical 8: Land Use Plan Preparation	**Practical hrs: 13**
Objectives	***Contents***
• Prepare a land use plan of an area.	• Field visit to study the existing land use plan of an area • Preparation of a sample land use plan of an area
Evaluation methods: oral and written tests and evaluation of work activities	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials
Practical 9: Watershed Management Plan	**Hrs Practical 12**
Objectives	Contents
• Identify the components of watershed • Be acquated with the process of preparation of Watershed management plan	Field visits Biophysical/Socioeconomic data collection

Community Forestry

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

Course Description
This course provides knowledge and skill in community forestry development and management including different aspects of community forestry second-generation issues, role of forest technicians in community forestry development, planning in community forestry development, production and management system, monitoring and evaluation in community forestry, planning processes in community forestry, approach to community forestry, social and transformative approach and its elements.

Course Objectives
The general objective of this course is to provide in-depth knowledge and skill in community forestry besides the course also raises forestry techniques awareness of their roles or responsibilities:

- Give an overview of community forestry programs in Nepal.
- Monitor and Evaluate community forestry programs in Nepal.
- demonstrate awareness of the roles and responsibilities

Reference books:

1. Community Forestry Guidelines 1995. Ministry of Forests and Soil Conservation. Department of Forest. Community and Private Forest Division, Babar Mahal, Kathmandu.
2. The Community and Private Forestry Program in Nepal. Ministry of Forests and Soil Conservation. Department of Forest. Community and Private Forest Division, Babar Mahal, Kathmandu.
3. D. A. Gilmour and R. J. Fisher Villagers, Forests and Foresters. The Philosophy, Process and Practice of Community Forestry in Nepal. . Sahayogi Press, Kathamndu.
4. Messerschmidt, Richard and Shrestha Forest User Groups in Nepal. , IOFP Technical Paper.
5. B. P. Kayastha., Elements of Community Forestry by
6. Field Manuals in Community Forestry. Nepal Australia Community Resource Management Project, Katmandu.
7. Forest act 2049 (1993) and Forest Rules 2051(1995) updated (revised version)
8. Master Plan for Forestry Sector 1988/89. MOFSC/GoN
9. Sustainable and effective management systems for community forestry – RECOFTC, Bangkok, report no.9.
10. Field manuals for community and private forestry. CFDD publications (4 volumes).
11. Current Community Forestry Guidelines

Course Contents

Course: Community Forestry	**Hrs. theory 117 Hrs. Practical 78**
Unit 1: Introduction to Community forestry	**Hrs theory 8**
Objectives	*Contents*
• Define community forestry	Definition/Objectives/Concept of community forestry

• Explain how community forestry evolved in Nepal • State the present status of CF in Nepal	History of Community forestry in Nepal. Terminologies used in communityforestry (CFUG, interest group, operational plan, constitution etc.) Status of CF in Nepal (Potential and Handed over area, Benefited HH, Population)
Evaluation Methods: Oral and written test, assignment	**Teaching/Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 2: Role of Forest Technician in Community Forestry	**Hrs theory 4**
Objectives	*Contents*
• State the role and responsibility of forest technician • Describe the quality of community workers • Explain arts of building rapport in the village	• Job description and responsibilities forest technician • Qualities of field worker/ Forest technician as Community workers • Art of building rapport in the villages by Forest technicians
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 3: RRA and PRA tools applicable in Community Forestry	**Hrs Theory 12**
Objectives	*Contents*
At the end of the session, students will be able to : • Define RRA and PRA • Describe various RRA and PRA tools Applicable in community forestry	Definition of RRA and PRA tools Characteristics of good RRA PRA and its applicability in CF Description of various RRA and PRA tools and their use in CF (only 10 as following): • Direct Observation • Key informants survey • Interest group discussion • Semi –structured interview • Sketch mapping • Participatory mapping • Transect walk • Ranking • Time charts (seasonal calendar) • Short, simple questionnaires
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 4: Community Forestry planning process	**Hrs Theory 26**
4.1: Investigation	***Hrs 10***
Objectives	*Contents*

• Define investigation in Community Forestry • Identify the users • Prepare social and forest inventories	• Definition of investigation in CF • Information to be collected during investigation, • Introduction/Definition of the Investigation • Methods of investigation • Users identification • Inventory (socio-economic survey, Forest inventory • Different methods of socio-economic survey and forest inventory
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
4.2: Negotiation	**Hrs.12**
Objectives	*Contents*
• Define negotiation • Explain the major issues and methods of negotiation	Definition of Negotiation The major issues to be negotiated Methods of Negotiation, factors/things to be considered during negotiation Preparation of CF constitution and operation plan, major contents to be included in both constitution and operational plan Community Forestry Hand over procedures (Letterto DFO,CFUG registration, certification and CF handover to CFUG and certification)
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
4.3: Implementation	**Hrs. 2**
Objectives	*Contents*
• Define implementation • Describe the process and art of of implementation	Definition of implementation The process and arts of implementation of constitution, operational plan and other directives of CF
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
4.4: Review and Revision	**Hrs 2**
Objectives	*Contents*
• Define review and revision in CF • Explain the way of re-visiting the constitution and operational plan in CF	Definition of review and revision in CF Description about what , when and how to make review and revision
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 5: Introduction to CF Guidelines	**HRS 8**
Objectives	

Describe various CF guidelines	• Community Forest Development Guidelines • Resource inventory guidelines • Buffer zone CF guidelines • Collaborative Forest guidelines
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 6: Livelihood Improvement Plan (LIP) and User Group Development Plan (UGDP)	**HRs 10**
6.1: Livelihood Improvement Plan	**Hrs 4**
Objectives	*Contents*
• Define and explain the process of developing livelihood improvement plan	Definition of livelihood improvement plan (LIP) Objectives and process of preparing livelihood improvement plan
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
6.2: User Group Development Plan	**Hrs 6**
Objectives	*Contents*
• Define User Group Development Plan • Explain Principles and process	Definition of User Group Development Plan (UGDP) Principles of UGDP Process of UGDP preparation Integration of LIP into UGDP
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 7: Community Forestry Management systems in Nepal	**Hrs 6**
Objectives	*Contents*
Explain forest management systems adopted by CFUGs in Nepal	• Production systems • Protection systems • Harvesting systems • Product distribution systems
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 8: Other Community Based Forest Management (CBFM) Models in Nepal	**Hrs Theory 12**
Objectives	*Contents*
• List different forest management regimes • State the comparative advantage and disadvantages of these regimes	Description about various forest management Models: • Collaborative Forest management • Buffer zone community forestry • Leasehold forestry,

	• Religious Forestry • Brief planning process of above CBFM models
Evaluation Methods: Oral and written test, assignment, Performance observation (Interaction and participation in the class)	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, text and reference books and Journals and reports.
Unit 9: Monitoring and evaluation	**Hrs Theory 5**
Objectives	*Contents*
• Define the term monitoring and evaluation • Discuss on objectives and methods of monitoring and evaluation • Discuss different monitoring and evaluation methods.	Definition Objectives of M&E Methods of M&E Define self-monitoring and evaluation systems in community forestry with indicators/checklists Public hearing and public auditing IEE (Initial Environment Examination) in community Forestry
Evaluation Methods: Oral and written test, assignment	Teaching /Learning activities and resources: Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 10: Role of different stakeholders in CF Management	**Hrs Theory 5**
Objectives	*Contents*
State the various stakeholders in CF management List the CF based activities of these stakeholders	Mandate of various stakeholders Department of Forest /District Forest Office FUG /FECOFUN NGO (NAF) / INGO (SDC) VDC/DDC, Local Resource Person (Facilitators)
Evaluation Methods: Oral and written test, assignment, Performance observation (Interaction and participation in the class)	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, text and reference books and Journals and reports.
Unit 11: CF Governance And Conflicts	**Hrs Theory 12**
11.1 Governance	**Hrs 6**
Objective	***Content***
Define governance List the features and criteria of Good governance	Definition and types of Governance (Poor and good governance) Principles of good governance Elements /characteristic features of good governance
Evaluation Methods: Oral and written test, assignment, Performance observation (Interaction and participation in the class)	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, text and reference books and Journals and reports.
11.2 Conflicts	**Hrs 6**
Define conflict and list its types Explain the causes of conflict Discuss how conflict is resolved	Definition, causes of conflict Various methods of conflict resolution

Evaluation Methods: Oral and written test, assignment, Performance observation (Interaction and participation in the class)	Teaching /Learning activities and resources: Class room instruction, Observation, illustration, diagrams, visuals, text and reference books and Journals and reports.
Unit 12: Gender and Community Forestry	**Hrs Theory 8**
Objective	*Content*
Define gender, social equity, justice and rights State the issues related to Gender and Social equity in community forestry	Gender, social equity, justice and rights Issues related to gender and social equity Gender and social equity mainstreaming in development Women/community empowerment for gender and social equity in development
Evaluation Methods: Oral and written test, assignment, Performance observation (Interaction and participation in the class)	Teaching /Learning activities and resources: Class room instruction, Observation, illustration, diagrams, visuals, text and reference books and Journals and reports.

Community Forestry Practical

Course: Community Forestry Practical	**Hrs Practical 78**
Practical 1: Community Forest boundar survey Survey and CF Inventory- Growing stock, volume, MAI, AAC calculation **Practical 2:** Socio-economic survey, User's need assessment (timber, fuelwood, fodder, grasses etc) **Practical 3:** Community Forestry Constitution Preparation	Hrs 16 Mobilize students for boundary survey, Community forestry Inventory (Growing stock, Volume, MAI, AAC calculation, Hrs 16 socio-economic survey- demand/supply assessment Hrs 16
Objectives	*Contents*
• Get overview on socio-economic data collection techniques in a community forest. • Expose on a content of CFUG constitution • Prepare a constitution of a community forest user group	RRA/PRA Questionnaire survey Interest Group Meeting CFUG General Assembly Content of CF constitution
Evaluation Methods: Oral and written test, assignment, Performance observation (Interaction and participation in the class)	Teaching /Learning activities and resources: Class room instruction, Observation, illustration, diagrams, visuals, text and reference books and Journals and reports.
Practical 4: Community Forestry Operational Plan Preparation	**Hrs 16**
Objectives	Contents

• Get overview on Forest Resources Information Collection Techniques (Forest Inventory) • Familiar with Data Analysis techniques of collection forest resources information to prepare CF operational plan. • Aware on content of CF operational plan and process of CF operational plan preparation. • Prepare a draft CF operational Plan	RRA/PRA Questionnaire survey Forest product demand Forest Resource Inventory Content of CF operational plan
Evaluation Methods: Oral and written test, assignment, Performance observation (Interaction and participation in the class)	Teaching /Learning activities and resources: Class room instruction, Observation, illustration, diagrams, visuals, text and reference books and Journals and reports.
Practical 5: Community Forestry Monitoring and evaluation	**Hrs 8**
Objectives	*Contents*
• Get overview on data collection techniques in a community forest monitoring and evaluation. • Expose on a Different monitoring and evaluation methods • Conduct monitoring and evaluation of a CFUG	RRA/PRA Questionnaire survey Forest product demand CF constitution, CF operational plan Monitoring tools
Evaluation Methods: Oral and written test, assignment, Performance observation (Interaction and participation in the class)	Teaching /Learning activities and resources: Class room instruction, Observation, illustration, diagrams, visuals, text and reference books and Journals and reports.
Practical 6: Conduction of Meeting and Assembly	**Hrs 6**
Objectives	Contents
Get overview regarding the methods and skills on EC meetings and general assemblies	Preparation of meeting/Assembly agendas Letter of invitation Meetings and assembly conduction

Forest Measurement

Total hours: 195 Full Marks: 100
Theory: 117
Practical: 78

Course Description:
This course deals with forest measurement (forest mensuration). This course provides basic knowledge and skills in forest resource inventory topics including timber estimation, forest sampling, forest carbon, stand yield prediction and calculation of volume for standing tree. The second part gives fundamental concept of forest management and its implications in forest planning and operations, emphasizing on forest planning principles (Such as sustained yield, growing stock, site quality, rotation age and annual allowable cut). Overall the course makes students able to conduct forest resource inventory.

Course Objectives:
Upon completion of this course, the student will be able to:

- prepare local volume table and use different volume tables
- execute different methods of sampling enumeration of the forest
- demonstrate an understanding of increment
- calculate the volume of different forest products
- estimate carbon pool of the forest
- estimate the growing stock of given forest

Recommended Text book and Reference books and manuals

- **Text book -** Forest Mensuration-L.S Khanna and A.N. Chaturvedi.International Book distributers,DehraDun,India .1982
- Community Forest Resource Inventory Guideline (Revised), 2061. Department of Forest Community Forest Division, Babarmahal, Kathmandu 2061
- Forest Measurement- Thomas Eugene Avery and Harold E. Burkhart McGrawHill Inc, 1994.
- Forest Mensuration- Betram Husch, Charles I. Miller and Thomas W. Beers .John Wiley sons.1982
- Forest Carbon Measurement Guideline,2067,.REDD forestry and Climate Change Unit,Babarmahal, Kathmandu

Course Contents

Course: Forest Measurement (Forest Mensuration)	**Hrs. theory 117 Hrs. Practical 78 Hrs.**
Unit 1: Introduction to Forest Mensuration	**Hrs. theory 5**
Objectives	Contents
Define Forest Mensuration State the importance and scope of Forest Mensuration	1.1 Definition of forest mensuration 1.2 Objective and scope of forest mensuration 1.3 Importance of forest mensuration in forest management 1.4 Bias, accuracy and precision
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in class	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks reference books, journals and other publications.

Unit 2: Measurement of standing trees	**Hrs. theory 20**
Objectives	Contents
List and describe various diameter measuring instruments Mention disadvantages and disadvantages of various diameter measuring instruments List and describe various height measuring instruments Mention advantages and disadvantages of various height measuring instruments Describe methods of height measurement in plain and hilly areas. State sources of errors in height and diameter measurement	2.1 Diameter measurement and its importance 2.2 Rules of DBH measurement 2.3 Diameter caliper, its use, advantages and disadvantages 2.4 Diameter tape, its use, advantages and disadvantages 2.5 Height measurement and its importance 2.6 Principles of height measurement (Trigonometric and geometric principles) 2.7 Methods of height measurement (Direct, indirect and instrumental) 2.8 Height measuring instruments and their uses a. Christen's hypsometer b.Clinometers c. Abney's level d. Vertex e. Transponder 2.9 Measurement of height of trees on plane and slopy areas 2.10 Sources of errors in height measurement
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in class	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks reference books, journals and other publications.
Unit 3: Measurement of form	**Hrs. theory 10**
Objectives	Contents
State the forms of a tree Define form factor and describe types of form factors Define form quotient and describe types of form quotients Explain the principles of Metzger's theory	3.1 Forms of a tree and Metzger's theory 3.2 Definition of form factor and its types 3.3 Uses of form factor 3.4 Definition of form quotient and its types
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in class	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks reference books, journals and other publications.
Unit 4: Measurement of felled trees and fuel-wood	**Hrs. theory 10**
Objectives	Contents
State different formulae for the calculation of volume of felled trees/logs and sawn logs. Compare the volume calculating formulae with one another and assess the overestimate and underestimate of volume by these formulas	4.1 Measurement of length, diameter and sectional area of logs 4.2 Different Formulae for volume calculation (Newton's, Huber's, Smalian's and Quarter Girth) 4.3 Calculation of volume of sawn timber 4.4 Dimensions and volume of chatta (staked fuel wood)

State the methods and formulas for fuelwood measurement	4.5 Measuring solid volume of firewood (Xylometric method and specific gravity method)
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in class	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks reference books, journals and other publications
Unit 5: Volume Table	**Hrs. theory 15**
Objectives	Contents
Define volume table State various types of volume tables, their uses and limitations State the process of preparing Local Volume Table (LVT) Differentiate between General Volume Table (GVT) and Local Volume Table (LVT)	5.1 Definition and concept of volume table 5.2 Types of volume tables 5.3 Preparation of local volume table by graphical method a. Based on basic data collected from field b. Derivation from general volume table 5.4 Uses of volume table, their advantages and disadvantages
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 6: Sampling and enumeration	**Hrs. theory 28**
Objectives	Contents
Define sampling Tell why sampling is desired in forest measurement Define enumeration State types of sampling and their relative advantages and disadvantages Sate the sampling design of Forest Inventory Guidelines of Nepal	6.1 Definition and scope of sampling 6.2 Concept of sampling -Population -Sample size -Sampling intensity -Sampling Error 6.3 Advantages and limitation of sampling in forestry 6.4 Definition and scope of total enumeration and its importance in forestry 6.5 Types of sampling (Probability/random and non-probability/non random sampling) a. Random sampling - Simple random sampling -Stratified random sampling -Multistage sampling -Multiphase sampling -Sampling with varying probabilities b. Non-random sampling -Selective sampling -Systematic sampling Line plot sampling and Strip sampling 6.6 Forest Inventory Guidelines -Salient features of the inventory Guidelines -Process of Plot establishment -Size of plot for tree, poles, saplings and seedlings -Sampling intensity 6.7 Estimation of the carbon pool of the forest

	a. Above ground forest carbon measurement method b. Below ground forest carbon measurement method
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in class	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks reference books, journal and other publications
Unit 7: Forest Increment	**Hrs. theory 9**
Objectives	Contents
Define the terms yield, growth and growth rate. Mention the types of measuring growth rate (increment) Differentiate between CAI and MAI	7.1 Definition and types of increment 7.2 Basic concept of diameter, height and volume increment 7.3 Concept of current annual increment and mean annual increment 7.4 Estimation of increment (diameter growth percentage and volume growth percent)
Define the terms yield, growth and growth rate. Mention the types of measuring growth rate (increment) Differentiate between CAI and MAI	7.1 Definition and types of increment 7.2 Basic concept of diameter, height and volume increment 7.3 Concept of current annual increment and mean annual increment 7.4 Estimation of increment (diameter growth percentage and volume growth percent)
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in class	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks reference books, journals and other publications
Unit 8: Community Forestry Inventory	**Hrs. 20**
Objectives	Contents
Define community forestry inventory and explain the process and methods of CF inventory	Definition of CF Inventory Process and steps of CF Inventory Methods of Inventory CF inventory guidelines

Forest Measurement Practicals- 78 Hrs

Practical 1: Measurement Diameter and Height	**Hrs. 14**
Objectives	*Contents*
Measure tree Diameter and Height	Use of height and diameter measuring instruments (Linear tape, caliper D-tape, Clinometer, Abney's level, Vertex , Transponder)
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks reference books, journals and other publications.

Practical 2: Preparation of Local Volume Table (LVT)	**Hrs. 15**
Objectives	*Contents*
Prepare Local Volume Table	Use of Graphical Method
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks reference books, journals and other publications.
Practical 3: Collection of forest inventory data	**Hrs. 25**
Objectives	*Contents*
Collect forest inventory data Apply forest sampling techniques	Use of the following sampling methods: -Random and systematic sampling -Line plot sampling -Strip sampling -Stratified sampling
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks reference books, journals and other publications.
Practical 4: Measurement of felled trees and calculate volume.	**Hrs. 12**
Objectives	*Contents*
Measure felled trees. Calculate volume of the felled trees.	Use of formulae: -Newton's, Smalian's, Huber's and Quarter girth
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks reference books, journals and other publications
Practical 5: Carbon pool measurement	**Hrs. 12**
Objectives	*Contents*
Measure above ground biomass	Use of aboveground and underground estimation of carbon pool methods
Measure underground biomass	
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks reference books, journals and other publications

Non-Timber Forest Products (NTFPs)

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

Course Description:
This course deals with Non Timber Forest Products (NTFPs). This course provides basic knowledge and skills in identification and management of NTFPs. Introduction, importance, production, harvesting, processing and use of NTFPs will be the main focus of this course, overall the course makes students able to understand how the NTFPs can be managed.

Course Objectives
Upon completion of this course, the student will be able to:

1. Explain the importance and scope of NTFPs.
2. Explain the economic cultivation and processing of NTFPs.
3. Explain the importance of medicinal plants.
4. Select and recommend the uses of harvested /marketed NTFPs
5. Explain the importance of value addition

Recommended Texts:

1. Chaudhary S., 2003. Manual of Forest Utilization,
2. Dutta I.C., 2007. Non Timber Forest Products of Nepal, HillSide Press (P) Ltd, Kathmandu
3. FRI and Colleges, 1970. Indian Forest Utilization, Vol.II, FRI Press, Forest Research Institute and Colleges, Dehradun, India.
4. GoN/DoPS, 2007. Medicinal Plants of Nepal (Revised), Bulletin No.28, Department of Plant Resources. Rashmi Offset Press, Kathmandu
5. Kunwar R.M., 2006. Non-timber Forest Products (NTFPs) of Nepal, Centre for Biological Conservation Nepal and International Tropical Timber Organization Japan.
6. Tewari, D.N.1994. A Monograph of Chirpine, International Book Distributors, Dehradun, India.
7. GoN/DoPS, 2061 BS. Jadibuti Abam GairkasthaVan Paidawar Niti, 2061BS
8. Bhattarai, D. Jadibuti Manjari, Suvash Priting Press, L.aitpur, Nepal
9. Shrestha U. and Shrestha S., 2061BS. Non-Iimber Forest Products of Nepal, Bhundi Prakashan Kathmandu, Nepal.
10. GoN/ DoPS, 2063 BS. Nepal Ko Arthik Bikas Ka Lagi Prathmikata Prapta Jadhibutiharu., Department of Plant Resources.

Course Contents

Course: Non Timber Forest Products	**Hrs. theory 117. practical 78**
Unit 1: Introduction of Non-Timber Forest Products (NTFPs)	**Hrs. 10**
Objectives:	Content:
Introduce NTFPs with definition as well as scope and importance Explain types and categories of NTFPs	Introduction and definition of NTFPs Importance and scope of NTFPs Economic Importance At Global level, At national level At local level Environmental importance Cultural Importance Types/ categories of NTFPs

	NTFPs of plant origin • Foods, • Forage • Ornaments • Fibres • MAP • Biochemicals • Toxin • Pharmaceuticalss NTFPs of animal origin • Wild animals • Birds • fish • Reptiles • Insects
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 2: NTFPs and Livelihood	**Hrs. theory : 6**
Objectives	Contents
Understand the role of NTFPs in livelihood improvement	Introduction and definition of Livelihood Role of NTFPs in livelihood improvement Role of NTFPs in employment and income generation
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 3: MAPS and NTFPs Development Policy 2061	**Hrs. theory 5**
Objectives	Content
Introduce about the present policy on NFFPs	long Term vision and objectives Policies Strategies
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, GoN publications.
Unit 4: Ethnobotany	**Hrs. theory -14**
Objectives	Contents
Introduce about the ethnic values of MAPs and NTFPs	Introduction and definition of Ethno botany Importance Of studying ethonobotany Past and present trends in ethnobotanical expedition Define Ethnic value of MAPS (10 species)and NTFPs (10 species) Describe the ethno botanical use of some important MAPs and NTFPs species
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams,

	visuals, textbooks and reference books, journal and publications.
Unit 5: Sustainable Harvesting of NTFPs	**Hrs. theory 15**
Objectives	Contents
Explain the importance of the sustainable harvesting of NTFPs	Definition of sustainable harvesting Importance of sustainable harvesting of NTFPs and MAPs Existing harvesting practices of NTFPs in Nepal Sustainable harvesting methods/techniques of NTFPs/MAPs from trees, shrubs, herbs, fungi, orchids
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 6: Resource Assessment	**Hrs. theory 15**
Objectives	Contents
Clarify the concepts and process of resources assessment	NTFPs Inventory (what and Why) Sampling types and techniques Detail measurement Detail estimation and action of various parts such as bark, leaf, roots etc
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 7: Resin Collection and Processing	**Hrs. theory 15**
Objective	Contents
Deliver the knowledge and ideas regarding resin collection and processing	Importance of resin collection in rural income Species tapped for resin tapping and some idea about chir pine trees and forest of Nepal Reasons for tapping resins from chirpine Principles and practices of resin collection Current method of resin collection in Nepal Processing of resin to manufacture rosin and turpentine Grading and marketing of rosin and turpentine Uses of rosin and turpentine
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 8: Medicinal and Aromatic Plants	**Hrs. theory 20**
Objective	Contents
Explain collection and extraction methods and use of commercially valuable MAPs	Importance and scope Domestication potentiality Nursery and cultivation techniques of Aloe vera, Asparagus racemosus, Swertia chirayita, Taxus wallichiana and Zanthoxylum armatum

	Collection & extraction methods, Parts used for medicine of commercially valuable plants Value and uses of MAPs
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 9: Marketting and marketing channels of NTFPs	**Hrs. theory 7**
Objective	Contents
Explain NTFPs market and marketing systems of Nepal	Definition of marketing Marketing channel Nepal Village level, Road head centres and City centres India third countries
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 10: Value Addition and Post Harvesting Technology	**Hrs. theory 10**
Objective	Contents
Define value addition and post harvesting technology	Define value addition Steps in value addition -Post harvesting practices -Processing for intermediate products -Production of consumer goods -Procesing (Distillation and Extraction) Good practices of value addition Importance of value addition Challenges of value addition in Nepal

Non Timber Forest Products (NTFPs) Practical 78 Hrs

Practical 1: Identification of at least 15 important NTFPs species other than MAPs	**Hrs 16**
Objectives	*Content*
To identify the NTFP species	Form a different group, assign the task , arrange the tools and identify the NTFPs species
Evaluation Methods: Written tests, field report, assignments and presentation, participation/ field work	Teaching/Learning activities and resources: Field visit, textbooks and reference books, journals and publications selected tools and field practices
Practical 2: Identification and drawing of at least 10 Medicinal and Aromatic Plants (MAPs)	**Hrs 16**
Objectives	*Content*
To identify the MAPs species	Form a different group, assign the task , arrange the tools and identify the MAPs species and draw sketches of identified MAPs such as Aegle

	marmelos, Adhatoda vasica, Aloe vera, Asparagus racemosus, Atemisia indica, Berberis aristata/asiatica, Centella asiatica, Cinnamomum tamala, Swertia chirayita, Mentha arvensis, Murraya coenigii, Ocimum tenuiflorum, Zanthoxylum armatum, Rauvolfia serpentina, Taxus wallichiana, etc. or other locally available MAPs
Evaluation Methods: Written tests, field report, assignments and presentation, participation/ field work	Teaching/Learning activities and resources: Field visit, textbooks and reference books, journals and publications selected tools and materials, field practices
Practical 3: Demonstration of the harvesting methods	**Hrs 16**
Objectives	*Content*
To demonstrate the harvesting methods of NTFPs	Organize the field day Select at least 5 NTFP species Demonstrate the harvesting methods/techniques in the field
Practical 4: Value addition processing exercise (drying, cleaning, storing etc.)	**Hrs 16**
Objectives	*Content*
Evaluation Methods: Written tests, field report, assignments and presentation, participation/ field work	Teaching/Learning activities and resources: Field visit, textbooks and reference books, journals and publications selected tools and materials
Practical 5: Field excursion regarding some NTFP processing and marketing.	**Hrs 14**
Objectives	*Content*
To visit the processing companies, observation and sharing	Organize the visit to processing company Make environment for observation and sharing on processing techniques and marketing of the products near by eg Lokta and Argeli, Bamboo, Grass processing,
Evaluation Methods: Written tests, field report, assignments and presentation, participation/ field work	Teaching/Learning activities and resources: Field visit, textbooks and reference books, journals and publications selected tools and materials

Forest Harvesting and Utilization

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

Course description
This course combines forest harvesting (part-I) and utilization (part-II). The first part provides harvesting tools and techniques, wood extraction and transportation and wood storage and marketing. The second part gives fundamental of utilization of forest products use, wood structure, properties and defects, uses of wood as energy source in Nepal, major forest products and industries in Nepal and non-wood forest products and industries in Nepal

Course objectives
By the end of this course, the student will be able to manage and conduct economical and appropriated harvesting practices of major and minor forest products and their proper utilization. Specifically, at the end of the course, the students will be able to:

- Carry out different methods of felling and logging.
- Demonstrate proper use and maintenance of harvesting hand tools and other equipments.
- Discuss various techniques of extraction of different forest products in hill and plain.
- Describe the appropriate method of log storage.
- Grade logs and arrange for their sale.
- Identify woods through the help of gross and anatomical structure of wood.
- Demonstrate knowledge of the properties of woods and their uses.
- Identify the various types of wood defects.
- Explain use of wood as a source of energy.
- Demonstrate knowledge of woods raw materials for use in industry.
- Demonstrate knowledge of wood seasoning and preservation.
- Identify and discuss about medicinal and aromatic plants and other NTFPs and their socio-economic value.

Recommended Texts

- Indian forest utilization, FRI, publication, vol. I & II.
- Logging practices, Steve Conway
- Practice amounting and logging Indian forest, utilization, and FRI publication vol. I & II.
- A handbook of forest utilization, T. Mehta.

Course contents

Course: Forest Harvesting and Utilization	**Theory hrs. 117 Practical hrs. 78**
Part I: Forest Harvesting	**Theory hrs: 63**
UNIT 1: Harvesting Tools and Techniques	**Theory hrs: 29**
1.1: Harvesting Tools and Equipment	**Theory hrs: 8**
Objectives:	***Content:***
List the appropriate forest harvesting tools and equipments Explain the use of those tools in different forest types and terrain condition.	Identification of tools and their significance Bill hook, axe and saw and its type, wedges, bow saw, cant hook, debarking spade, measuring

Explain the process of procurement of tools.	stick, power chain saw, cable puller, stem tightened, bow saws Feller bunchier, forwarder, skidder Procurement of tools Cross cut saw Power chain Saw
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
1.2: Storage and Maintenance of Tools	**Theory hrs: 6**
Objectives:	***Content:***
• Understand the storage and maintenance of tools and equipments used in forest harvesting	• Carriage and storage • Routine maintenance • Sharpening • Stetting • Oiling • Resifting and remanding of wooden handled tools
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
1.3: Harvesting Techniques	**Theory hrs: 15**
Objectives:	***Content:***
• Understand the general rules and season of harvesting of forest products. • Understand the methods of forest products harvesting	• General rules in felling trees • Marking of trees and record keeping • Season of felling trees • Method of felling trees • Stump extraction
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 2: Forest Products Extraction	**Theory hrs: 10**
2.1: Concept of Ergonomy and Safety Measures	**Theory hrs: 5**
Objectives:	***Content:***
• Discuss the concept of ergonomics and safety measures during harvesting operation of forest products.	• Concept of ergonomics • Safety measures • Forest Product Harvesting, Collection and Distribution Guidelines (Nepal Government)
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
2.2: Log Extraction	**Theory hrs: 5**

Objectives:	***Content:***
• Understand the appropriate method of extraction wood e.g. sliding, rolling and skidding.	• Extraction wood by sliding, rolling and skidding
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Unit 3: Transportation of Forest Products	**Hrs theory: 16**
3.1: Loading and Unloading	**Theory hrs: 3**
Objectives:	***Content:***
• Explain the methods of loading and unloading of forest products.	• Loading and unloading by manual and mechanical system
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
3.2: Transportation of Forest Products	**Theory hrs: 11**
Objectives:	***Content:***
• Understand the method of forest products transportation manually as well as mechanically by land, water way and air. • Explain the tools of method of forest products transportation.	• Transportation of timber by man, animal, and cart • Transportation by motor, truck and railway • Transportation by aerial or overhead system - Donald portable gravity rope way - Power rope way - Highland cable system - Skyline cable system • Water transportation - Telescopic floating and its advances and disadvantages - Rafting - Wet slider - Boom (One way boom or single arm boom / Two way boon of v- shaped boom)
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 4: Wood Storage and Marketting	**Theory hrs: 10**
4.1: Log Storage and Depot Management	**Theory hrs: 5**
Objectives:	***Content:***
• Understand the method of forest products storage and method of staking logs.	• Log depot and its type • Method of stacking logs, timber and poles
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books

4.2: Log Grading and Marketing	**Theory hrs: 5**
Objectives:	***Content:***
• Able to grade and market the forest products	• Understand and explain natural and other than natural defects of wood. • Natural defects eg. Knots, shake, cross grain, reaction wood etc. • Defects other than natural eg. Seasoning defects, fungal defects, insects and animal defects etc.
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Part II: Forest Utilization	**Theory hrs: 54**
UNIT 1: Introduction of a Timber as a Material	**Theory hrs: 3**
Objectives:	***Content:***
• Define timber and find out its importance and uses.	• Definition of timber (Need to go for the beginning) • Use of timber in daily life • Industrial use of timber
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 2: Wood Structure, Properties and Defects	**Theory hrs: 17**
2.1: Wood Structure	**Theory hrs: 7**
Objectives:	***Content:***
• Understand and explain gross and minute structure of wood.	• Gross structure of wood, e.g. bark, sapwood/heartwood, growth rings, early, wood grain and texture, pith • Minute structure of wood, e.g. vessels, wood parenchyma, Tracheas, fibers, tyloses and other inclusions in pores, rays, pith flecks, ripple marks, intercellular canals.
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
2.2: Wood Properties	**Theory hrs: 5**
Objectives:	***Content:***
• Understand and explain mechanical and physical properties of wood.	• Mechanical properties of wood (strength, compression of wood, elasticity, flexibility) • Physical properties of wood (density, hardness, thermal and electrical conductivity and insulation
2.2: Wood Defect	**Theory hrs: 5**

Objectives:	***Content:***
• Understand and explain wood defects	• Define wood defects • Explain the types of wood defects • Explain their effects on wood quality
UNIT 3: Uses of Wood as Energy Source in Nepal	**Theory hrs: 10**
3.1: Uses of Wood in Nepal	**Theory hrs: 5**
Objectives:	***Content:***
• Understand and explain various uses of wood in Nepal.	• Structural uses of wood • Decorative uses of wood • Specialized uses of wood
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
3.2: Wood as Energy Source	**Theory hrs: 5**
Objectives:	***Content:***
• Understand and explain wood as importance energy source in Nepal.	• Wood as Energy Source • Wood as fuel • Wood charcoal • Improved cook stoves • Contribution of wood in total energy consumption in Nepal
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 4: Major Forest Products Industries in Nepal	**Theory hrs: 19**
4.1: Saw Milling	**Theory hrs: 4**
Objectives:	***Content:***
• Understand and explain types of saw milling and it operations.	• Principles of was milling • Types of saw mills: permanent saw mill, portable saw mill • Saw milling operations
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
4.2: Plywood and Composite Boards	**Theory hrs: 5**
Objectives:	***Content:***
• Understand and explain use and importance of plywood. • Explain the process of plywood manufacturing.	• History, use and importance of plywood production in Nepal • Characteristics of timber species useful for plywood manufacture • Plywood manufacturing process

	• Process of making particle board and block board
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
4.3: Match Production	**Theory hrs: 2**
Objectives:	***Content:***
• Understand and explain process of making matches.	• Raw materials • Process of making matches
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
4.4: Pulp and Paper Processing	**Theory hrs: 4**
Objectives:	***Content:***
• Understand and explain importance and process of pulp and paper making process.	• Importance of pulp and paper • Pulp making processing
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
4.5: Wood Preservation	**Theory hrs: 4**
Objectives:	***Content:***
• Understand and explain importance and process of wood preservation.	• Importance of wood preservation • Methods of wood preservation
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 5: Non-Timber Forest Products	**Theorty hrs: 5**
Objectives:	***Content:***
• Define NTFP, MFP • Identify NTFPs • Enlist NTFPs	• Definition of NTFPs, MAPs and NWFP • Identification of NTFPs • Listing of NTFPs • Utilization of NTFPs in general
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books

Forest Harvesting and Utilization Practical

COURSE: Forest Harvesting and Utilization Practical	**Practical hrs: 78**
Practical 1: Introduction to chain saw, bows and other equipments.	**Practical hrs: 8**

Objectives:	***Content:***
• Explain how chain saw, bows and other equipments work.	• Observe chain saw, bow saw and other equipments and their parts • Study how chain saw, brows and other equipments work
Evaluation methods: oral and written tests and field work activities evaluation	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.
Practical 2: Introduction to non-timber forest products	**Practical hrs: 10**
Objectives:	***Content:***
• List major non-timber forest products available in the surrounding forest area. • Explain use of major non-timber forest products available in the surrounding forest area.	• Field visit to the surrounding forest and identify major non-timber forest products • Study local and commercial use of major non-timber forest products
Evaluation methods: oral and written tests and field work activities evaluation	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.
Practical 3: Practice for harvesting and logging.	**Practical hrs: 16**
Objectives:	***Content:***
• Demonstrate skills of timber harvesting and logging using standard rules and procedures.	• Visit timber harvesting area of nearby forest • Practice of timber felling. logging and stacking
Evaluation methods: oral and written tests and field work activities evaluation	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.
Practical 4: Visual grading of timber	**Practical hrs: 10**
Objectives:	***Content:***
• Grade logged timber on visual basis.	• Visual grading of selected timber in wood depot (TCN Depot)
Evaluation methods: oral and written tests and field work activities evaluation	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.
Practical 5: Wood identification	**Practical hrs: 10**
Objectives:	***Content:***
• Demonstrate skills of wood identification.	• Identification of sample hard and soft wood pieces in the laboratory
Evaluation methods: oral and written tests and field work activities evaluation	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.

Practical 6: Strength, density and moisture content determination	**Practical hrs: 10**
Objectives:	***Content:***
• Demonstrate skills in strength, density and moisture content determination.	• Determination of strength, density and moisture content of selected timber species in the laboratory
Evaluation methods: oral and written tests and field work activities evaluation	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.
Practical 7: Visit to wood-based industries of Nepal	**Practical hrs: 14**
Objectives:	***Content:***
• Identify major forest products • Explain the production processes (of major products) of selected wood-based industries in Nepal.	• Visit selected wood-based industries in Nepal and study the production processes of major products
Evaluation methods: oral and written tests and field work activities evaluation	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, field visits and reference materials.

Agroforestry

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

Course Description:

The course will begin with basic introduction of agroforestry, its components, principles, objectives, characteristics and importance in Nepalese context. This introductory discussion provides detailed discussions of agroforestry species and agroforestry systems. The course will enhance capacity of students in collecting field information and designing small agroforestry models for both agriculture and degraded forest lands. The course will cover both biological and social science aspects of agroforestry.

Course objectives:

- Define and classify agroforestry systems of Nepal.
- Select both tree and crop species suitable for different agroforestry practices.
- Identify the general problems of farmers and farming systems that agroforestry intends to address and design a small agroforestry project.
- Identify suitable species for horticulture, agriculture and animal farming along with tree and forage crops suitable for different agro-ecological zones of Nepal.

Recommended Texts:

- Amatya, S.M. (1994) Agroforestry System and Practice in Nepal, National Forest Division, Ministry of Forests and Soil Conservation, Kathmandu Nepal.
- Chundawat, B.S and Gautam, S.K (1999) Textbook of Agroforestry, Oxford and IBH publishing CO.PVT LTD, New Delhi India.
- Negi, S.S (2007) Agroforestry Handbook, International Book Distributors, Dehra Dun, Uttarakhand India.
- Dwivedi, A.P. (2012) Agroforestry principles and practices, Oxford and IBH publishing CO.PVT LTD, New Delhi India.
- Amatya, S.M, Shrestha, K.R and Cedamon, E. (2016) Nepal Forestry Handbook, Nepal Forester's Association, Kathmandu Nepal
- Amatya, S.M, Cedamon, E and Nuberg, I. (2017) Agroforestry systems and practices in Nepal, AFU Hetauda Nepal.
- Joshi, M.R, Pandit, B.H, Amatya, S.M and Dhakal, B. (2017) Agroforestry and Entrepreneurship Development Training Manual, Nepal Agroforestry Foundation Koteshwor Kathmandu Nepal.
- Joshi, M.R *et al* (2018) Agroforestry Training of Trainers manual, IUCN/FAO Kupandol, Lalitpur Nepal.

Course Contents

Course: Agroforestry	**Hrs. theory 117 Hrs. practical 78**
Unit 1: Introduction to Agroforestry	**Hrs theory 14**
Objectives	Content
Define agroforestry, its principles, objectives, characteristics and discuss the importance and scope of agroforestry in	• Definition and concept of agroforestry • Components of agroforestry

Nepalese context and correlate agroforestry with Forestry and agriculture	• Principles, objectives and characteristics of agroforestry • Importance and scope of agroforestry based on economic, social and environmental reasons • Disadvantages and or limitation of agroforestry • History of agroforestry in Nepal • Agroforestry promoter in Nepal: An introduction to Nepal Agroforestry Foundation (NAF) • Relationships of agroforestry with forestry and agriculture sciences
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, powerpoint presentation, illustrations, diagrams, visuals, textbooks and reference books, Journals and publications.
Unit 2: Agroforestry systems classification	**Hrs. theory 15**
Objectives	Content
Classify agroforestry systems of Nepal.	• Purpose of agroforestry classification and criteria used for agroforestry systems classification (Structural basis, functional, socio-economic and ecological basis) • Different agroforestry systems of Mountain, Hills and Terai region of Nepal • Agri-silviculture • Horti-silviculture • Silvipastoral system • Agri-silvo-pastoral systems • Aqua-Silviculture • Shelter belts and wind breaks • Home garden • Alley cropping • Taungya agroforestry • Shifting cultivation (Slash and burn)
Evaluation Methods: Written tests, Home assignments and presentation, participation/ interaction in class.	Teaching/Learning activities and resources: classroom instruction, power point presentation, illustrations, diagrams, visuals, textbooks and reference books, Journals and publications.
Unit 3: Species selection for agroforestry	**Hrs. Theory 23**
Objectives	Content
Select fodder, forage, fuel-wood and timber and green manure for agroforestry development and to analyze the comparative benefits of the recommended species over the traditional ones.	• Multipurpose species • Fodder and forage species • Fuel wood species • Shade trees • Timber species

	• NTFPs of different agro-ecological zones etc suitable for agroforestry practices • Green manure, its function and cultivation practices • Criteria for tree and agriculture crop selection in an agroforestry system
Evaluation Methods: Written tests, Home assignments and presentation, participation/ interaction in class.	Teaching/Learning activities and resources: classroom instruction, power point presentation, illustrations, diagrams, visuals, textbooks and reference books, Journals and publications.
Unit 4: Fruit based agroforestry production	**Hrs. Theory 17**
Objectives	Contents
List the economically important fruits in Nepal by geographical regions and todiscuss about cultivation techniques and marketing of those listed fruit species	• Definition of horticulture and its branches • Importance of fruits based agroforestry practices • Classification of fruits based climatic condition (Tropical fruits, sub-tropical fruits and temperate fruits) • Fruit orchard of Nepal (Home, local market and commercial orchards) • Fruit nursery techniques • Propagation techniques of different fruits (division and separation, cutting, layering, grafting, inarching, budding and tissue culture) • Fruits planting techniques • Cultural operations (weeding, mulching, training and pruning) • Major insect, pest and diseases • Harvesting and post harvesting techniques • Markets and marketing of fruits
Evaluation Methods: Written tests, Home assignments and presentation, participation/ interaction in class.	Teaching/Learning activities and resources: classroom instruction, power points, illustrations, diagrams, visuals, textbooks and reference books, Journals and publications.
Unit 5: Vegetable based agroforestry production	**Hrs. theory 17**
Objectives	Contents
List the important of vegetables in Nepal and to discuss about cultivation techniques and marketing of those listed vegetable species	• Importance of vegetables based agroforestry practices • Classification of vegetables based on season and part used • Vegetable gardening systems of Nepal (Home garden, market garden, commercial or truck farming, vegetable forcing, vegetable production for processing etc) • Propagation techniques

	• Nursery techniques • Cultivation techniques of vegetables • Cultural Operation (weeding, mulching, manuring and irrigation) • Major insect, pest and diseases • Harvesting and post harvesting techniques • Market and marketing of vegetables
Evaluation Methods: Written tests, Home assignments and presentation, participation/ interaction in class.	**Teaching/Learning activities and resources:** classroom instruction, power points, illustrations, diagrams, visuals, textbooks and reference books, Journals and publications.
Unit 6: Animal based production systems	**Hrs. theory 6**
Objectives	Contents
Explain importance of animal based agroforestry, animal herding systems of Nepal and its constraints.	• Animal herding systems of Nepal • Importance of animal based agroforestry practices • Definition of grazing and grazing systems • Constraints of animal based production systems of Nepal
Evaluation Methods: Written tests, Home assignments and presentation, participation/ interaction in class.	**Teaching/Learning activities and resources:** classroom instruction, power points, illustrations, diagrams, visuals, textbooks and reference books, Journals and publications.
Unit 7: Utilization of abandoned and underutilized agriculture lands through agroforestry and private forestry	**Hrs. theory 10**
Objectives	Contents
Select best bet agroforestry and private forest practice for abandoned and underutilized agriculture lands	• Farming systems of Nepal and its components. • Agriculture farm land abandonment and its causes • Criteria such as farmer's need and interest, utilization abandoned and underutilized agriculture lands, low labour requirement, reduction of human wildlife conflict, beneficiary groups, market availability, income and employment generation, environment sustainability, and policy and institutional support etc for selection of best bet agroforestry options for abandoned agriculture lands • Private forests development and management in abandoned agriculture lands • Planting techniques and plantation management such as weeding, cleaning, manuring and tree management practices

	such as singling, pruning, thinning, coppicing, pollarding and lopping to reduce shading effects of trees to under storey crops
Evaluation Methods: Written tests, Home assignments and presentation, participation/ interaction in class.	**Teaching/Learning activities and resources:** classroom instruction, power points, illustrations, diagrams, visuals, textbooks and reference books, Journals and publications.
Unit 8: Design of Small Agroforestry project	**Hrs. theory 15**
Objectives	Content
Define project and to collect biophysical and socio-economic data and identify the problems of agroforestry and design an appropriate agroforestry project to address the problems	• Biophysical and Socio-economic information needed for agroforestry project design • Problems and objective analysis • Collected data analysis • Strategy or guidelines for agroforestry project design • Definition and setting of objectives of a project • Design a small agroforestry project • Case studies of completed agroforestry projects.
Evaluation Methods: Written tests, Home assignments and presentation, participation/ interaction in class.	Teaching/Learning activities and resources: classroom instruction, power points, illustrations, diagrams, visuals, textbooks and reference books, Journals and publications.
Agroforestry Practical	**Hrs Practical 78**
Practical 1: Field exposure on agroforestry systems	**Hrs. practical 12**
Objectives	Contents
Students will visit nearby agrofrestry field/farms run by the community /farmers and collect data on various components of an agroforestry systems Give presentation	• Develop checklist for discussion with farmers on agroforestry during field visit • Field visit of agroforestry site • Identification of agroforestry species • Field visit report preparation and submission
Evaluation Methods: home assignment, individual presentation of field report, participation/interaction in the field	**Teaching/Learning activities and resources:** Class room instruction, demonstration and presentation
Practical 2: Seedling production techniques of trees, NTFPs/Fruit /Vegetables and plantation	**Hrs. Practical 40**
Objectives	Content
Learn Nursery techniques of some selected species of NTFPs/fruit/vegetable practically Learn cultivation techniques of some selected species of NTFPs/fruit/vegetable practically	• Field visit of nursery and practice nursery bed preparation, seed treatment techniques, seed germination test, seed sowing and seedling transplanting in polybags, watering, manuring, weeding, grading and root pruning

Identify pest/disease/insect affecting the crops Carry out cultural operations in the field	• Collect insect/pest and disease affected plants for identification • Plantation techniques and cultural operations
Evaluation Methods: Written and viva, individual presentation, participation/interaction in the field	Teaching/Learning activities and resources: Instruction at the visit site, demonstration, field practical
Practical 3: Selection of best bet agroforestry options for abandoned agriculture lands	**Hrs. Practical 14**
Objectives	Contents
Students will visit near by abandone agriculture lands and learn about best bet agroforestry options selection techniques	• Develop formats with criteria such as farmer's need and interest, utilization abandoned and underutilized agriculture lands, low labour requirement, reduction of human wildlife conflict, beneficiary groups, market availability, income and employment generation, environment sustainability, and policy and institutional support • Field practice will be done with farmers to select best bet agroforestry options using these criteria for scoring 1-5 based possibility of agroforestry options • Selection of high scoring agroforestry options
Evaluation Methods: Written and viva, individual presentation, participation/interaction in the field	Teaching/Learning activities and resources: Instruction at the visit site, demonstration, field practical and IUCN developed agroforestry TOT manual will be used to select best bet agroforestry options.
Practical 4: Design agroforestry model	**Hrs Practical 12**
Objectives	Contents
Students will visit nearby agroforestry project site and collect and identify agroforestry components, collect socio-economic and biophysical data, identify the problems of the project site and design agroforestry project	• Preparation of data collection format • Use of PRA techniques to collect field data • Identify farmer's main problems related to fodder and forage, fuel wood, timber and soil conservation etc and setting objectives • Collect information, analyze it and design a small project
Evaluation Methods: Home assignment, agroforestry project presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Class room instruction, demonstration and observation and field exercise

Third Year

1. Forest Protection
2. Forest management
3. Extension Education
4. Forest Policy and Law
5. Forest Surveying and Engineering
6. Entrepreneurship Development
7. Office Management
8. Work Experience Programme (WEP)

Forest Protection

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

Course Description:
This course deals about forest protection. This course provides basic knowledge and skills in forest protection topics introduction and importance of forest protection, factors causing damage to forest, damaged caused by biotic agents in nursery and forest, damage caused by human and domestic animals and forest fire and control measures. Overall the course makes students able to understand how the forest can be protected from different damaging factors.

Course Objectives
Upon completion of this course, the student will be able to:
- Understand the importance of forest protection
- Gain knowledge about the different factors which can cause damage to a forest and plants in nurseries
- Know various factors causing damage to forest

Recommended Texts:

1. L.S. Khanna ,Forest protection, Khanna Bandhu, Goyal Enterprise, Delhi,India
2. P. Savill and Julinan Evans:Plantation forests in the temperate regions,
3. B.K. Bakshi, Forest Pathology,.Forest Research Institute and College, Dehradun
4. The Ecology and Control of Forest Insects of India and Neighboring countries, C.F.C. Beeson.
5. SS Negi -Handbook of Forest Protection by (IFS) International Book Distributer, Dehradun, India
6. Dr. PB Meshram, Text book of Forest Entomology, Khanna Bandhu, Goyal Enterprise, Delhi, India
7. Jeffrey A, Kenton R. Miller, Timothy B. Werner: Conserving the world's Biological Diversity, IUCN, WRI, The World Bank, 1990
8. Nepal Biodiversity Strategy Implementation Plan 2006-2010: Ministry of Forest and Soil Conservation (MOFSC), GEF/UNDP 2006

Course Contents

Course: Forest Protection	**Hrs. theory 117. Hrs. practical 78**
Unit 1: Introduction and importance of Forest Protection	**Hrs. theory 7**
Objectives:	Content:
At the end of the session, students will be able to : • Define Forest Protection • State the scope and importance of Forest Protection	-Concept and definition of forest protection by various writers - Scope and Importance of forest protection in forest management -Difficulties in forest protection
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 2: Factors causing damage to forest	**Hrs. theory 30**

2.1: Abiotic Factors	Hrs. theory - 15
Objectives	Contents
Introduce abiotic factors causing damage to forest	Define abiotic factors Description about Soil condition, temperature, precipitation, wind and as abiotic factors and its possible damages to forest
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
2.2: Biotic factors	Hrs. theory - 15
Objectives	Contents
Introduce biotic factors causing damage to forest	Definition of biotic factors Description of bacteria, fungi, phanerogamic parasites, insects, birds, mammals and human beings) as biotic factors and their possible damages to forest
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 3: Damages caused by the biotic agents in Nursery and Forest and their control measures	**Hrs. theory 43**
3.1: Plant disease, symptoms and effects	**Hrs. theory 5**
Objectives	Content
Know about the plant disease, symptoms and effects	Definition of plant disease Description of the symptoms and associated effects
3.2: Host-parasite relationship	**Hrs. theory 3**
Objectives	Content
Understand about the host-parasite relationship	Definition and host and parasitic plants The host –parasite relationship (Hosts, Parasites, epiphytes)
3.3: Fungal disease	**Hrs. theory 9**
Objectives	Content
Introduce students about fungal disease and associated control measures	Definition of fungal disease The heart and root disease of *Shorea robusta, Dalbergia sisoo and Acacia catechu* , Damping off disease The control measures for them
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
3.4: Insects	**Hrs. theory 9**
Objectives	Content
Understand the diseases caused by the insects	Define the disease caused by the various insects

	Introduce Sissoo bark borers, bamboo borers, pine borer, teak defoliater and their control measures Describe life cycle of Sal Borer (*Hoplocyrambycs spinicornis*) its damage and control measures.
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
3.5: Important nursery pest and their control	**Hrs. theory 7**
Objectives	Contents
Define nursery pests and associated control measures	Define nursery pests Describe the following nursery pests, damages caused by them and suggest to their control measures: • Cockchafers(white grub) • Cut worm (surface caterpillar) • Cricket • Termites (white ant) • Grasshopper • Defoliator • Sap sucker
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
3.6: Wild animals	**Hrs. theory 5**
Objectives	Contents
Define wild animals, possible damages and control measures	Define wild animals with examples Describe the damage caused by them and suggest to their control measures
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
3.7: Invasive plants	**Hrs. theory 5**
Objectives	Contents
Define invasive plants and their control measures	Define the invasive plants with examples Describe and suggest to their control measures
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 4: Biodiversity Conservation	**Hrs. theory 6**
Objectives	Content
Introduce about the concept and practices of bio diversity conservation and its relation with forest protection	Definition of Bio diversity The forest bio diversity and its conservation status in Nepal Conservation of biodiversity through sustainable forest management

	Relation between biodiversity conservation and forest protection
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 5: Damage caused by Domestic animals	**Hrs. theory 3**
Objectives	Contents
Understand the damages caused by the domestic animals	Define domestic animals Explain the possible damages caused by the domestic animals (Grazing and Browsing- Grazer and Browser) Describe the different grazing management system
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 6: Damage caused by Humans	**Hrs. theory 15**
6.1: Encroachment and Illegal felling	**Hrs. theory 5**
Objectives	Contents
Define forest encroachment and illegal felling	Define encroachment and illegal felling Explain the status and consequences of forest encroachment and illegal felling in forest Protection of Nepal
6.2: Improper cultivation practices and development works	**Hrs. theory 5**
Objectives	Contents
Understand about improper cultivation practices and different development works and their effects in forest protection	Define improper cultivation practices in Nepal- Farming practices Explain different development works performed inside and outside the forest and associated effects on forest protection
6.3: Deforestation and shifting cultivations	**Hrs. theory 5**
Objectives	Contents
Define deforestation and shifting cultivations	Define deforestation and shifting cultivation Explain salient features of deforestations and shifting cultivations in Nepal Describe and suggest the correction /improvement measures
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 7: Forest Fire	**Hrs. theory 10**
Objective	Contents
Define and classify the forest fire, its damage and control measures	Define forest fire Explain the causes of forest fire Describe the types of Forest fire

	Explain the possible damages causing by forest fires Describe its prevention and control measures Describe fire detection/fire alert system List out and explain the beneficial effects of forest fire
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 8: Role of stakeholders in Forest Protection in Nepal	**Hrs. theory 3**
Objective	Contents
Explain the roles and responsibilities of stakeholders in Nepalese Forest Protection	Define stakeholders in forest protection Explain the roles and responsibilities of different stakeholders in forest protection in Nepal
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.

Forest Protection Practical-78 Hrs

Practical 1: Construction of fire lines and fire breaks	**Hrs-16**
Objectives	*Content*
To construct the fire lines and fire breaks	Form a different group, assign the task , arrange the tools and construct the fire-lines and fire breaks
Evaluation Methods: Written tests, field report, assignments and presentation, participation/ field work	Teaching/Learning activities and resources: Field visit, textbooks and reference books, journals and publications selected tools
Practical 2: Firefighting measures	**Hrs-8**
Objectives	*Content*
To make known about the fire fighting measures with practical skills	Explain fire fighting measures Arrange all fire fighting tools Demonstrate to the students and suggest them to use the tools and methods in demonstration field.
Evaluation Methods: Written tests, field report, assignments and presentation, participation/ field work	Teaching/Learning activities and resources: Field visit, textbooks and reference books, journals and publications selected tools and materials
Practical 3: Mechanical and chemical control of insects and diseases in the nursery and nearby forests	**Hrs-8**
Objectives	*Content*
To demonstrate methods of chemical and mechanical control of insects and disease in the nursery and forest	Explain mechanical control measures Orient the students regarding this practical in the field.

	Visit the nursery and forest stand and demonstrate the practical works
Evaluation Methods: Written tests, field report, assignments and presentation, participation/ field work	Teaching/Learning activities and resources: Field visit, textbooks and reference books, journals and publications selected tools and materials
Practical 4: Protection from grazing. Demonstration of different kinds of fences and walls	**Hrs -16**
Objectives	*Content*
To demonstrate about protection from grazing	Visit different forest sites and settlements where fences are constructed for protection, area where stall feeding for livestock is promoted and grazing is discouraged.
Evaluation Methods: Written tests, field report, assignments and presentation, participation/ field work	Teaching/Learning activities and resources: Field visit, textbooks and reference books, journals and publications selected tools and materials
Practical 5: Identification of basic pathogens, pests and remedial measures	**Hrs-8**
Objectives	*Content*
To identify and demonstrate the basic pathogens, pest and their remedial measures	Explain the methods of the identification of basic pathogens, pests and demonstrate the remedial measures
Evaluation Methods: Written tests, field report, assignments and presentation, participation/ field work	Teaching/Learning activities and resources: Field visit, textbooks and reference books, journals and publications selected tools and materials
Practical 6: Protection against wild animals	**Hrs.-16**
Objectives	*Content*
To demonstrate the methods of protection from wild animals	Explain the methods of protection from wild life Manage to visit the concern sites and demonstrate the methods and results
Evaluation Methods: Written tests, field report, assignments and presentation, participation/ field work	Teaching/Learning activities and resources: Field visit, textbooks and reference books, journals and publications selected tools and materials
Practical 7: Visiting to key stakeholders and experience sharing regarding the protection of forest resources in Nepal	**Hrs- 6**
Objectives	*Content*
To visit to different key stakeholders and sharing about the forest protection in Nepal	Identfy and make list of key stakeholders of Forest Arrange short visit to them and make sure to share the facts, figure and experiences
Evaluation Methods: Written tests, field report, assignments and presentation, participation/ field work	Teaching/Learning activities and resources: Field visit, textbooks and reference books, journals and publications selected tools and materials

Forest Management

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

Course Description
This course deals with forest management. This course provides basic knowledge and skills in fundamental concepts of forest management and its implications in forest planning and operations, emphasizing on forest planning principles (Such as sustained yield, growing stock, site quality, rotation age and annual allowable cut). Overall the course makes students able to prepare a forest management plan for sustainable forest management.

Course Objectives
Upon completion of this course, the student will be able to:

- demonstrate understanding of the definition scope, logic and principles of forest management
- demonstrate an understanding of forest product demand and supply
- understand use and non-use value of forest
- understand forest product valuation
- demonstrate an understanding of forest product marketing and business plan for Forest Based Micro Enterprises
- demonstrate understanding of forest management plans
- prepare a management plan of a given forest area

Recommended Texts

- Prakash, Ram. Forest Management (latest edition) Khanna Bandhu, Dehradun, India.
- Davis, Lawrence S., K. Norman Johnson, Pete Bettinger, & Theodore Howard. Forest Management (latest edition) McGraw-Hill Science, USA.
- Pant, M. M. Forest Economics and Valuation (latest edition) Natraj Publications, Dehradun, India.
- Leuschner, William A. Forest Resource Management (latest edition) John Wiley & Sons, Inc., USA

Course Contents

Course: Forest Management	**Hrs. theory 117 Hrs. practical 78**
Unit 1: Introduction to forest Management	**Hrs. theory 5**
Objectives	Contents
Define forest management Sate the forest management practices in Nepal Approaches of managing state owned/community forest/ private owned forest	1.1 Definition of forest management 1.2 Objectives of forest management 1.3 Scope of forest management 1.4 History of forest management in Nepal
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 2: Classification of Forest in Nepal	**Hrs. theory 7**
Objectives	Content

State the purpose and basis of forest classification in Nepal List and describe the forest types on functional basis. List and describe the forest type on legal basis List and describe the forest type on geographical basis List and describe the forest type based on nature List and describe the forest types based on age.	2.1 Purpose of forest classification 2.2 Classification of forest of Nepal on different basis 2.2.1 Geographical and climatic (ecological) 2.2.2 Legal 2.2.3 Territorial/Administrative 2.2.4 Silvicultural 2.2.5 Functional 2.2.6 Method of regeneration 2.2.7 Age 2.2.8 Composition 2.2.9 Growing stock
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 3: Ecological aspects of forest management	**Hrs. theory 10**
Objectives:	
Define various ways plants can vary in their natural environment List and use techniques to quantify plant diversity	3.1 Variation and diversity due to genotype, phenotype and environment interactions 3.2 Quantitative analysis of plant diversity 3.2.1 Alpha (α), beta (β) and gamma (γ) diversity 3.2.2 Simpson's Diversity Index (D) and Shannon Index (H_s)
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 4: Normal Forest	**Hrs. theory 8**
Objectives:	Content
Define Normal Forest List the characteristics of a normal Forest List the characteristics of abnormal forest Classify and describe the types of normal forest	4.1 Definition of normal forest 4.2 Concept of normal forest 4.3 Attributes of normality 4.4 Kinds of abnormality 4.5 Implication of normality concept in 4.5.1 Even aged forest 4.5.2 Uneven aged forest
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 5: Growing Stock and increment	**Hrs. theory 10**
Objectives	Content
Define Growing stock and increment State the methods of determining the actual growing stock in a forest.	5.1 Definition of growing stock, increment and its type 5.2 Determination of actual growing stock 5.3 Normal growing stock and its determination 5.3.1 Determination of NGS in clear felling system based on final MAI

Determine the Normal Growing Stock (NGS) State the significance of site quality in growing stock.	5.3.2 Determination of NGS in selection system based on CAI (Munger's formula) 5.3.3 Determination of NGS in uniform shelterwood system (Fischer's formula) 5.4 Site quality and its determination
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 6: Rotation or production period	**Hrs. theory 9**
Objectives	Content
Define rotation List and describe the types of rotation List ad describe the points that affect the length of a production period List and describe the points to be considered by a forester before finalizing the rotation period.	6.1 Definition and concept of rotation 6.2 Types of rotation 6.2.1 Physical and silvicultural 6.2.2 Rotation of maximum volume production and technical rotation 6.2.3 Rotation of highest income and financial rotation 6.3 Concept of rotation in regular and irregular forest 6.4 Choice of rotation 6.5 Conversion period
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 7: Yield regulation	**Hrs. theory 10**
Objectives	Content
Define yield and its type Conceptualize principle and practice of sustainable yield management Conceptualize yield management Describe use of yield table	7.1 Yield and its type 7.2 Principle of sustained yield management 7.3 Concept of yield regulation 7.3.1 By area 7.3.2 By volume 7.4 Yield table and its uses
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 8: Forest management for ecosystem services	**Hrs. theory 6**
Objectives	Content
Define ecosystem services. List and describe the categories of ecosystem services Understand the concept and management of forest in supplying major ecosystem services Describe payments for ecosystem services (PES)	8.1 Concept of ecosystem services 8.2 Various categories of ecosystem services and their examples – provisioning, regulation, cultural, and supportive 8.3 Management of forest for supplying major ecosystem services – carbon, biodiversity, hydrology 8.4 Concept of payments for ecosystem services (PES)

Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 9: Sustainable forest management	**Hrs. theory 14**
Objectives	Content
Define sustainable forest management Principle, criteria and indicators of sustainable forest management Forest certification and its implication in Nepal	9.1 Concept of sustainable development 9.2 Definition and concept of sustainable and scientific forest management 9.3 Objectives of sustainable forest management 9.4 Principles, criteria, indicators and verifiers of sustainable forest management 9.5 Concept of forest certification 9.6 Various forest certification schemes 9.7 Scope of forest certification in Nepal 9.8 Case studies of forest certification
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 10: Forest Management plan/Operational plan	**Hrs. theory 12**
Objectives	Content
Define and state the need of forest Planning Describe objectives and scope of operational Plan List the characteristics of a good operational Plan. State the components of an operational plan	10.1 Definition, objectives and scope of management plan 10.2 Characteristic of good management plan 10.3 Preparation of forest management plan 10.4 Community forest operational plan write up process 10.5 Process of updating management plan
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 11: Forest valuation	**Hrs. theory 12**
Objectives	Content
Define use and non use values Different forest valuation techniques	11.1 Concept of forest valuation 11.2 Definition of use and non use values 11.3 Forest valuation techniques 11.3.1 Direct market price 11.3.2 Indirect market price 11.3.3 Non market price
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.
Unit 12: Valuing stumpage	**Hrs. theory 6**

Objectives	Content
Define stumpage Calculation of stumpage values	12.1 Definition of stumpage 12.2 Methods of calculating stumpage values
Unit 13: Demand and supply of forest products	**Hrs. theory 8**
Objectives	Content
Define concept of demand and supply of forest products Price determination of forest products Market analysis of forest products	13.1 Basic concept of demand 13.1.1 Definition of demand 13.1.2 Demand function 13.1.3 Law of demand 13.1.4 Determinants of demand 13.2 Basic concept of supply 13.2.1 Definition of supply 13.2.2 Supply function 13.2.3 Law of supply 13.2.4 Determinants of supply 13.3 Price determination of forest products
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks and reference books, journal and publications.

Forest Management Practicals

Course: Forest Management	**Hrs. practical 78**
Practical 1: Observation and classification of forests	**Hrs. practical 7**
Objectives	*Content*
Classification of forest on different basis	Observation and classification of forests on different basis (Ecological, legal, age, etc)
Practical 2: Determination of growing stock	**Hrs. practical 7**
Objectives	*Content*
Determine growing stock in community forest	Calculate actual growing stock of the forest Measure height, diameter and calculate volume of standing trees Compute density of regeneration
Practical 3: Preparation of community forest operation plan (steps and methods)	**Hrs. practical 15**
Objectives	*Content*
Analyze the data Prepare operational plan for forest management	Tabulation and analysis of data Operational Plan preparation
Practical 4: Plant diversity analysis	**Hrs. practical 12**
Objectives	*Content*
Conceptualize ecological basis of forest management	Analyze data on counts of trees, presence or absence of species. Quantify species richness, species diversity, differences in species composition and vegetation structure
Practical 5: Observation of Sustainable forest management (both government and community managed)	**Hrs. practical 12**

Objectives	*Content*
Conceptualize sustainable forest management	Observe different forest management system(community based, government managed) and evaluate their sustainability
Practical 6: Socio economic survey on demand and supply of forest products in community	**Hrs. practical 15**
Objectives	Content
To analyze demand supply conditions of community forest user group	Determine the total demand of forest products by households on yearly basis Determine the supply of forest products by community forest on yearly basis
Practical 7: Forest certification	**Hrs. practical 10**
Objectives	Content
Implication of forest certification	Case study of forest certification
Evaluation Methods: Oral and written tests, Home assignments and presentation, participation/interaction in the field	Teaching/Learning activities and resources: Field visit, textbooks and reference books, journals and publications.

Extension Education

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78
Course Description:
The course intends to develop students' skills in selection of extension methods/techniques, and organizing and conducting meeting. The course also provides knowledge on communication, planning, preparation and use of audio-visual aids, presentation and evaluation techniques.

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

a. Understand concepts and principles of forestry extension
b. Communicate and work with communities.
c. Design and evaluate specific programs for the rural setting
d. Conduct a meeting in a community.
e. Plan and produce simple extension materials.
f. Discuss and explain motivation tools

Recommended Texts

- Dongol B. B. S. -*Extension Education*- Prativa Singh DongolJha L.K. & Srama P.K.S.- *A Manual of Forestry Extension Education,*APH Publishing
- Negi, S. S.- *Forestry Extension Hand Book,* International Book Distributors.
- Supe, S. V. -*An introduction to extension Education*, Oxford and IBH Publishers
- Dongol, B. B. S. and Joshi, N. N.- *A text book of extension education*
- Rathire, O.S., Chauhan, M.S., Dhakar, S.D., Ojha, S.N.- *Handbook of Extension Education*, Agrotech Publishing Academy: Udaypur
- Sim, D. & Hilmi, H.A. *Forestry Extension Methods*, 1987, Food and Agriculture Organization
- Ray, G.L., Bhattacharya, K., Maity, S.K.- *A study in Foretsry Extension*, Naya Prakash
- *Livelihood Improvement Planning Training Manual* by the Nepal-Australia Community Resource Management and Livelihoods Project, Kathmandu Nepal.
- *Guidelines for Second Generation Community Forest Operational Plan Preparation* by the Nepal-Australia Community Resource Management and Livelihoods Project, Kathmandu Nepal.

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- Schramm, W. ***Process and Effects of Communication***. University of Illinois Press.
- Ruetz, N.1997. *Effective Communication. Improving Reading, Writing, Speaking, and Listening Skills in the Workplace*, Mass: Addison-Wesley.

Course Contents

Course: Forestry Extension	**Hrs. theory 117 Hrs. Practical 78**
Unit 1: Extension Education	**Hrs Theory 6**
Objectives	***Content***
Define Extension Education Discuss Principles of Extension Education Discuss scope of Extension in forestry Tell how learning is gained. Discuss the role and qualities of an extension worker	1.1 Definitions/Scope/Objectives/ principles of extension education in forestry 1.2 Learning process, elements of learning and ladder of learning 1.3 Role and qualities of extension workers
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, textbooks and reference books, and journal/ publications project reports.
Unit 2: Motivation and Perception	**Hrs. theory 10**
Objectives	***Content***
Discuss on Motivation and perception List and explain the methods of Motivation Describe the theory of motivation List and discuss how Motivation can be acheived Discuss the theories of perception	2.1 Definition of Perception, Motivation and its importance in forestry extension 2.2 Theories of Motivation: Carrot and stick theory of Motivation; Maslow's Hierarchy of needs; Herberg theory; Hawthorne effect 2.3 Different methods of motivation 2.4 Different theories of Perception:Top- down theory and Bottom-Up theory
Unit 3: Communication in forestry extension	**Hrs. theory 15**
Objectives	***Content***
Tell what is communication List and describe of types of communication Discuss about the barriers in Communication Describe various modes of communication and their effectiveness in forest extension	3.1 Definition of Communication and its importance in forest extension 3.2 Elements of Communication 3.3 Different types of communication and their relative advantages and disadvantages 3.4 Mode of Communication-Print -Audio, video, Audio-visual -Broadcasting, -Indigenous- Drumming, puppet show 3.5 Barriers of communication-types and how to overcome them
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, textbooks and reference books, and journal/ publications project reports.
Unit 4: Methods of Extension in forestry	**Hrs. theory 13**
Objectives	***Content***
List the methods of extension methods Discuss the relative advantages and disadvantages of extension methods Differentiate between various extension Methods	4.1 Individual method, group Method and Mass method 4.2 Common types of methods used in forest extension programs under Individual, Group and Mass methods- home visit, field visit, meeting, seminars, Focal group Discussion, Demonstration, exhibition, broadcasting

	4.3 Advantages and disadvantages of Individual, group and Mass method 4.4 Criteria of selection of appropriate method
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, textbooks and reference books, and journal/ publications project reports.
Unit 5: Teaching Aids	**Hrs. theory 10**
Objective	***Content***
Define teaching aids Discuss importance of teaching aids in extension Prepare and design of Audio-visual aids List basic components of a leaflet/brochure	5.1 Define Teaching Aids 5.2 Various types of common teaching aids- Audio, Visual and Audio-Visual aids (Leaflets/Brochures, pamphlets, poster, Overhead projector, Slide, filmpuppet show
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, textbooks and reference books, and journal/ publications project reports.
Unit 6: Program Planning	**Hrs. theory 15**
Objectives	***Content***
Tell what is a program planning List and describe the process of program planning	6.1 Definition of program planning and importance 6.2 Planning cycle 6.2.1 Steps in planning- • Situation analysis, • Developing questionnaire • Conducting interviews and surveys • Work plan • Calendar of operation • Implementation /execution of plan • Monitoring and evaluation • Review and formulation of another plan
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, textbooks and reference books, and journal/ publications project reports.
Unit 7: Monitoring and Evaluation	**Hrs. theory 15**
Objectives	***Content***

Tell what is monitoring and evaluation Describe the importance of monitoring and Evaluation in forestry extension List the types of evaluation Discuss the criteria of Evaluation List the steps of Evaluation Prepare a evaluation plan	7.1 Definition of program monitoring and program evaluation 7.2 Importance of monitoring 7.3 Importance of evaluation: (For learning and development, for accountability – to show others that you are effective) 7.4 Types of Evaluation 7.4.1 Qualitative Vs Quantitative Evaluation 7.4.2 Internal evaluation VsExternal evaluation 7.4.3 Preliminary evaluation Formative evaluation Summative evaluation 7.4.4 Discuss various components/ steps of an Evaluation Plan (EP)- (Developing an evaluation plan, assessing the results, communicating the results and Recommendations) 7.4.5 Discuss criteria of Evaluation
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, textbooks and reference books, and journal/ publications project reports.
Unit 8: Gender and social equity	**Hours theory 13**
Objectives	***Content***
Define gender, social equity, justice and rights Tell what are the major issues related to gender and social equity in forestry Describe how gender and social equity mainstreams in development Define empowerment Discuss the factors playing role in women empowerment. Explain gender sensitive planning	8.1 Definition/Concept of gender, social equity, justice and rights, empowerment 8.2 Discuss issues related to gender and social equity in forestry 8.3 Discuss mainstreaming gender in development: National and international convention on gender and their agenda and mandate- for mainstreaming issues of gender and equity 8.4 Define Empowerment and discuss factors affecting women empowerment 8.5 Gender sensitive planning
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, textbooks and reference books, and journal/ publications project reports.
Unit 9: Development	**Hours theory 10**
Objectives	Content
Define development Tell what are the issues of development in developing countries Discuss types of development	9.1 Definition 9.2 Various issues and challenges of development (economic, political, environmental, geographical and social) 9.3 Various types of development: development - natural resources, infrastructure, ecotourism etc
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, textbooks and reference books, and journal/ publications project reports.

Unit 10: People's participation	**Hours theory 10**
Objectives	Content
Define participation. Discuss its importance in social development and program Planning Discuss the nature and characteristics of participation List the types of participation List the level of participation	10.1 Definition of participation; its characteristics 10.2 Importance of participation in social development and program planning 10.3 Case studies of participation- e.g Annapurna Conservation Area 10.4 Types of participation 10.5 Various level of participation
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in class	Teaching/Learning activities and resources: classroom instruction, illustrations, textbooks and reference books, and journal/ publications project reports.

Forestry Extension Practicals

Practicals	**Hrs Practical 78**
Practical 1: Prepare **extension materials**	**Pr. Hrs 16**
Objectives	***Content***
Prepare brochure/Leaflets/Poster	Discuss about how to prepare and finalize extension materials
Practical 2: Prepare power point presentation	**Pr. Hrs 16**
Objectives	*Content*
Prepare powerpoint slides and present	Discuss about how to prepare and finalize extension materials
Practical 3: Prepare questionnaire	**Pr. Hrs 8**
Objectives	***Content***
Prepare checklist and questionnaire for field survey Conduct household survey, focus group discussion	Discuss about checklist and questionnaire for field survey, households survey, focus group discussion and key information interview
Practical 4: Conduct a meeting	Pr. Hrs. 8
Objective	***Content***
Conduct meeting in community	Discuss how to conduct a meeting in the community Simulate meeting by role playing in class
Practical 5: Prepare work plan	**Pr. Hrs 15**
Objectives	***Content***
Understand the process of program planning	Prepare a work plan based on the steps of planning cycle of the given hypothetical situation
Practical 6: Evaluate one of the forestry projects	**Pr. Hrs 15**
Objectives	Content
Evaluate one project	Discuss about the evaluation of forestry projects and their extension activities.
Evaluation Methods: Presentation and Performance level in the field	Teaching/Learning activities and resources: Project documents, Books and journals

Forest Policy and Law

Total: 78 hrs **Full Marks: 50**
Theory: 78 hrs

Course description
This course combines Forest Policies and Laws which provides Forest Laws and Forest Polices, Rules and Regulations.

Course objectives
The students will gain general knowledge about the principles and practices of forest policy, forest law, rules and regulations.

- Prepare time line of major changes of forestry sector policy in Nepal
- Explain salient features of major policies in Nepal.
- Explain the legal procedures of forest protection and conservation.
- Explain the implementation and procedures of forest rules and regulations.

Recommended Texts and Reference Books

- Nepal Ain Sangrah, Volume 7, revised.
- Forest Act 2049(with latest amendment)
- Muluki Ain (latest new 2075)
- Wetland policy 2068
- NTFP Policy 2061
- Nepal Biodiversity Strategy 2014
- Nepal Niyan Sangrah, Volume 7, revised.
- Climate Change Policies

Course Contents

Course: Forest Policies, Laws and Office	**(Theory hrs. 78)**
UNIT 1: Major Forestry Sector Policies	**Theory hrs: 10**
Objectives	**Content**
• Explain the timeline and major shift of forest policies in Nepal. • Explain main features of important forest policies of Nepal.	• Timeline of forest policy development • Major shift in forest policy in Nepal • Introduction and objectives of major forest policies • Current Forest Policies (Active) • National Forestry Plan, 2033 • Forestry Sector Strategy • Master Plan of Forestry Sector 1988 • Wetland policy 2068 • NTFP policy 2061 • Nepal biodiversity strategy 2014 • Climate Change Policy
Evaluation methods: oral and written tests and home assignments, class work	**Teaching / learning activities & resources:** classroom instruction, illustrations, diagrams, visuals textbooks and reference books

UNIT 2: Forest Law, Regulation and Guidelines	**Theory hrs: 14**
Objectives	**Content**
Explain objectives and salient features of Forest Act, Regulation and Guidelines	• Forest Act 1993 (with amendments) • Forest Regulation 1995(with amendments) • Private Forest nationalization Act 1956 • Forest Products collection, sale and distribution guidelines ,2000 (with amendments)
Evaluation methods: oral and written tests and home assignments/class work	**Teaching / learning activities & resources:** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 3: National Parks and Wildlife conservation Acts, regulations and Guidelines	**Theory Hrs 32**
Objectives	**Content**
Explain objectives and salient features of National Park and Wildlife Conservation Act, Regulations and guidelines	• National Parks and wildlife Conservation Act 2029 • National Parks and wildlife Conservation Regulation 2030 • Chitawan National Park Regulation 2030 • Himali National Park Regulation 2036 • Wildlife reserve regulation 2034 • Conservation Area Management Regulation 2053 • Conservation Area Government Management Regulation 2075 • Buffer zone management regulation 2052 and guidelines
Evaluation methods: oral and written tests and home assignments, Class works	**Teaching / learning activities & resources:** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 4: Soil and Water Conservation Act and Regulations	**Theory Hrs 3**
Objectives	**Content**
Explain objectives and salient features of Soil and Water Conservation Act, and Regulation.	• Brief introduction to Soil and Water Conservation Act, 2039 • Soil and Water Conservation Regulation,2042(1985)
Evaluation methods: oral and written tests and home assignments, class work	**Teaching / learning activities & resources:** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 5: Plant Protection Act	**Theory Hrs 2**
Objectives	**Content:**
• Explain objectives and salient features of Plant Protection Act, 2029	• Objectives and salient features of Plant Protection Act, 2029

Evaluation methods: oral and written tests and home assignments	**Teaching / learning activities & resources:** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 6: Legal Procedures and Charge sheets	**Theory Hrs 12**
Objectives	**Contents**
Explain the legal procedures and development of charge sheet as authorized by the prevailing laws and regulations.	• Legal procedures of forest offences • Sarjmin Muchulka, Bharpai, Bayan, Khantalasi Muchulka. • Charge sheets preparation and case filling procedures
Evaluation methods: oral and written tests and home assignments	**Teaching / learning activities & resources:** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 7: Forest related treaties and conventions	**Theory Hrs 5**
Objectives	**Contents**

Explain main features of important international treaties and conventions related to the forest and biodiversity sector.	• Introduction and objectives of important international treaties and conventions related to the forest and biodiversity sector.
	  • Ramsar Convention 1973
	  • CITIES
	  • Convention on Biological Diversity (CBD)

Evaluation methods: oral and written tests and home assignments	**Teaching / learning activities & resources:** classroom instruction, illustrations, diagrams, visuals textbooks and reference books

Forest Surveying and Engineering

Total hours: 195 **Full Marks: 100**
Theory: 117
Practical: 78

Course Description
This course provides basic knowledge about principles and techniques of Survey, mapping techniques and basics of Engineering. This course is divided into eleven units. The first unit gives general knowledge on fundamental concept of forest surveying. The second unit deals with the linear measurement including the use of instruments and error elimination. The third unit describes about the chain surveying, method of chain surveying and method of area calculation. The fourth unit explains the compass survey, system of angular measurement and instruments. The fifth unit deals with the traversing technique. The sixth unit relates to leveling, its methods and application of leveling. The seventh unit deals with the plane table surveying technique, its principles and methods. The eighth unit deals with the contouring of height information. The ninth unit discuss about the application of GPS technology in mapping. The tenth unit relates with the forest road, bridges, culverts, trails and causeways. The eleventh unit tells about building construction and its estimation.

Course Objectives
This course has the following objectives:

- gain knowledge and skills necessary to enable them to prepare and interpret basic maps and plans correctly
- demarcate /Check boundary, identify and rectify the encroachment area
- prepare detailed topographical maps using different types of instruments
- prepare stock maps for felling areas and landslide areas
- work with users groups in mapping and estimating in forest resources

Recommended Texts

- Surveying, Vol. I- Dr. B. C. Punmia
- Forest Surveying – Ram Prakash
- Surveying and Leveling Vol. I – T. P. Kanerkar
- Surveying – Rack C. McCormac, Pentice-Hall Inc
- Standard norms develop by Ministry of Forest and Environment
- Forest Engineering without tears – N. J. Masani
- Building Construction – Sushil Kumar
- Estimating and Costing – B. N. Dutta
- Manual of highway design and construction – K. R. Tuladhar
- Manual of bridges and culverts – K. R. Tuladhar
- GIS for beginners-ICIMOD
- Introduction to Arch View GIS-ESRI
- Getting to Know Arch view GIS- ESRI
- Principles of GIS-Peter A.Burrough and Rachel A.McDonnel

Course Contents

Course: Surveying, Mapping and Engineering	**Hrs. theory 117 Hrs. Practical 78**
Unit 1: Fundamental Concepts	***Hrs. theory 10***
1.1: Basic definition and classification	**Hrs. theory 6**
Objectives	**Contents**
Define forest surveying and engineering classified survey techniques. Describe the scope of surveying in forestry Principles of surveying	Survey, Relation of surveying with social surveying, Leveling, Traversing, Triangulation, map, plan, direction, distance, elevation and height Classification: Primary division of surveying: Plane surveying and Geodetic surveying Detailed classification: Based upon nature of survey and based upon instrument Object and scope of survey in forestry Principles of surveying
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
1.2: Use of Mathematics in surveying	**Hrs. theory 2**
Objectives	**Contents**
Get knowledge of mathematics List the types of scales Describe the methods of representing scales	Knowledge of algebra, trigonometry and geometry System of measurements and units Scales Methods of representing scales Types of scales: Plane scale and diagonal scale
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
1. 3: Types of Maps and their uses	**Hrs. theory 2**
Objectives	*Contents*
List the types of maps Describe their uses and applicability in forestry Tell the mapping techniques Describe their application methods Describe map reading methods	Types of maps Mapping skills Uses of different maps Map reading skills
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 2: Linear Measurement	***Hrs. theory 14***
2.1: Methods of linear measurement	**Hrs. theory 2**
Objectives	**Contents**
Describe the methods of linear measurement	Direct method Indirect method: Cosine correction formula, intersection in plane table etc. Measurement by using instruments: pacing , pass meter, odometer, speedometer and chaining (taping)

Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
2.2: Instruments used in linear measurement	**Hrs. theory 2**
Objectives	**Content**
List the instruments used in linear measurement Describe the types of various instruments used in linear measurement	Chains, tapes, ranging arrows, ranging rods, plum bob, abney's level, Sunto clinometer
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
2.3: Methods of chaining on sloping ground	**Hrs. theory 2**
Objectives	**Contents**
Explain various methods of chaining on sloping ground	Direct method Indirect method (Abney level method), Sunto clinometer
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
2.4: Ranging	**Hrs. theory 2**
Objectives	**Contents**
Define ranging Describe methods of ranging	Direct ranging Indirect ranging Random line method
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
2.5: Offsets	**Hrs. theory 2**
Objectives	**Contents**
Define offsets Classify types of offsets Describe the methodology of taking offsets	Perpendicular offset Oblique offset Swinging method, 3:4:5 method, ½ base issocellous triangle method, optical square method
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
2.6: Obstacles in chaining and ranging	**Hrs. theory 2**
Objectives	**Contents**
Point out the basic problems in Chaining and describe the methods of addressing the problems List the obstacles in chaining Describe various methods of avoiding obstacles	Obstacles in Chaining Obstacles in Ranging Obstracles in chaining but not in ranging Obstracles in ranging but not in chaining
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books

2.7: Errors and mistakes in linear measurement	**Hrs. theory 2**
Objectives	**Contents**
Explain the errors and mistakes that may occur in linear measurement	Errors and mistakes during linear measurement Types of errors Discrepency and precision
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 3: Chain Surveying	***Hrs. theory 5***
Objectives	**Contents**
Explain the chain triangulation technique, its mathematical derivation and application	Definition of chain survey ,Principal of chain surveying Definition of chain triangulation good condition and ill-condition of triangles Stations: main stations, sub-stations, tie-stations Lines: base lines, check line, tie line Field Book and its types
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 4: Compass Survey	***Hrs. theory 14***
4.1: Basic definitions	**Hrs. theory 3**
Objectives	**Content**
Define functional terms and instruments that could be used in compass survey Describe the magnetic, true and arbitrary meridian	Angle, meridians, bearings Horizontal and vertical angles Types of meridians: True, magnetic and arbitrary Types of bearings: True, magnetic, arbitrary, FB and BB Angle of Dip and declination: Agonic and Isogonic line, relation between true bearing, magnetic bearing and declination
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
4.2: System of bearings	**Hrs. theory 3**
Objectives	**Contents**
Describe about the different systems of bearing measurements	R. B. System WCB system Conversion from one system to another Calculation of angles from bearings in both systems
Evaluation methods: Oral and written test, home assignment	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
4.3: Compass: an instrument	**Hrs. theory 4**
Objectives	**Contents**
Describe about the theory of compass survey, types of compass, errors in compass survey	Theory of magnetic compass Theory of prismatic compass

and numerical base of angles, bearings and local attraction	Errors in compass survey: Local attraction and observational error Numerical base on angles, bearings and local attraction
Evaluation methods: Oral and written tests, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
4.4: Theodolite	**Hrs theory 4**
Objectives	**Contents**
Describe briefly handling of theodolite Introduction on field application	Introduction to theodolite Temporary adjustment of theodolite Mehod of calculating angle
Evaluation methods: Oral and written tests, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 5: Traversing	***Hrs. theory 4***
5.1: Basics of traversing	**Hrs. theory 4**
Objectives	**Contents**
Define traversing technique in surveying Describe about the types of traversing	Definition of traversing Types of traverse: Open,Link and closed traverse
Evaluation methods: Oral and written test, home assignment	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 6: Leveling	***Hrs. theory 9***
6.1: Fundamental definition	**Hrs. theory 3**
Objectives	**Contents**
Define leveling and its techniques	Levelling, Bench Mark, MSL, Level line, level surface, horizontal line, plumb line, line of culmination, Line of sight, fore sight, back sight, turning point, height of instrument
Evaluation methods: Oral and written tests, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
6.2: Methods of leveling	**Hrs. theory 2**
Objectives	**Contents**
Gain skills in various methods of leveling	Spirit leveling (auto level)
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
6.3: Application of spirit level	**Hrs. theory 4**
Objectives	**Contents**
Describe about the application of spirit level Getting know handle the level instrument'	Simple application Height of instrument method Rise and fall method Care of level instrument properly

Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 7: Plane Table Surveying	***Hrs. theory 5***
7.1: Basics of plane table surveying	**Hrs. theory 3**
Objectives	**Contents**
Define and describe the principles of plane table surveying Compare plane table surveying with other types of surveys	Definition Principles of plane table surveying Accessories Advantages and disadvantages of plane table survey Comparison of plane table with other types of surveys
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
7.3: Methods of plane tabling	**Hrs. theory 2**
Objectives	**Contents**
Describe the methods of plane tabling	Radiation Intersection Traversing Resection
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 8: Contouring	***Hrs. theory 4***
Objectives	**Contents**
Define contouring technique Describe the characteristics of contour lines	Basic definition of contour, contour interval, index line, horizontal equivalent Characteristics of contour lines
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 9: GPS survey	***Hrs. theory 8***
Objectives	**Contents**
Describe GPS system and how it works Integrate GPS and GIS	Fundamental of GPS Components of GPS How it works? GPS errors Differential GPS Integration of GPS and GIS
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 10: Forest road, bridge, trail and side drainage	***Hrs. theory 12***
10.1: Forest road	**Hrs. theory 7**
Objectives	**Contents**
Define forest roads Describe different types of roads Explain about the standards of forest roads	Definition of forest road and its purpose

	Types of forest roads: earthen, graveled, WB Macad road, Black top road, bridal paths, inspection paths Forest road standards Requirements of a good forest road Road structure (cross section of road) Road alignment (plain and hill) Extra widening of road sight distance
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
10.2: Bridge, road drainage and culverts	**Hrs. theory 5**
Objectives	**Contents**
Describe the types of bridges, culverts and cause ways Describe road drainage	Types of bridges used in forest roads: temporary suspension, wooden beam and girder and wooden cantle bridges Types of culverts and cause ways used in forest roads Road drainage in forest roads
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 11: Building construction and Rate analysis	***Hrs. theory 12***
11.1: Building Construction	**Hrs. theory 4**
Objectives	**Contents**
Define building construction List the activities for building construction Describe types and standards of different activities of building construction	Foundation and types Flooring and types Mortar and types Plastering, pointing, skirting, RCC, PCC, scaffolding, centering, shuttering and shoring
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
11.3: Plan, estimate and cost	**Hrs. theory 8**
Objectives	**Contents**
Prepare the plan of building Estimate and calculate costs for building construction	Estimate and its purpose, Abstract of cost and bill of quantity norms Rate analysis of pipe culvert and wooden bridge
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 12: Introduction to GIS vector and Raster	***Hrs.* theory *20***
Unit 12.1: Introduction to GIS	***Hrs.* theory *11***
Objectives	Content
Define GIS. Answer "What GIS can answer"	• Define GIS • Scope and importance of GIS

List the components of GIS Define GIS terminologies. Explain about the application of GIS and Surveying on forestry and natural resource management sector	• Components of GIS • GIS terminologies • GIS software: ArcGIS and QGIS • GIS Solutions for Surveying • Application of GIS and Surveying on NRM
Evaluation methods: Oral and written test, home assignments, interaction at class, project, seminar	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 12.2: Vector and Raster GIS	**Hrs. theory 9**
Objectives	Content
Describe the vector and Raster GIS Explain about the vector and raster representation of data	General definitions/ Introduction Vector and Raster representation of data
Evaluation methods: Oral and written test, home assignments, interaction at class, project, seminar	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams, visuals, textbooks, reference books

Surveying and Engineering Practicals

Course: Survey and Engineering Practical	**Practical 78**
Practical 1: Introduction to surveying instruments	**Hrs. Practical 3**
Objectives	***Contents***
Get familier with different surveying instruments	Handling of surveying instrument, measurement techniques, Pacing method,
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.
Practical 2: Linear measurement	**Hrs. Practical 3**
Objectives	***Contents***
Get skills in linear measurement	Stepping method, abney level method
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.
Practical 3: Ranging	**Hrs. Practical 6**
Objectives	***Content s***
Conduct Ranging in the ground	Direct Ranging Indirect Ranging
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.
Practical 4: Compass Traversing	**Hrs. Practical 8**
Objectives	***Content s***
Do practice to use traversing techniques(To prepare plan or map)	Compass traversing and detailing Map reading methods
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.
Practical 5: Leveling	**Hrs. Practical 8**
Objectives	***Contents***
Use leveling techniques in ground	Height of instrument method Rise and fall method

Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.
Practcial 6: Introduction and use of Theodolite	**Hrs Practical 3**
Objectives	***Content***
Introduce basic concept on use of theodolite	Introduction and simple handling of theodolite in its use in surveying
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.
Practical 7: GPS data collection and acquisition	**Hrs. Practical 6**
Objectives	***Content***
Acquire GPS data in the field	Field technique of GPS survey Data capture, store and retrieve
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.
Practical 8: Road alignment	**Hrs. Practical 5**
Objectives	***Content***
Align a small portion of the road	Profile and cross section of road
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.
Practical 9: Drawing and estimate of a single bedroom forest guard house with thatch or CGI floor and pipe culvert	**Hrs. Practical 10**
Objectives	***Content***
Draw a small building Prepare the estimate of small buildings	Draw a small building Prepare the estimate of small building
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.
Practical 10 : Work on ArcMap 10+	**Hrs. Practical 13**
Objective	Content
Carry hands on ArcMap 10+	Familiarize with ArcMap Software Symbolization and Labelling
Evaluation Methods: Written tests, home assignments and presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Field visit, textbooks and reference books, journals and publications.
Practical 11: CF Mapping	**Hrs. Practical 13**
Objective	Content
Carry hands on mapping CF	Export excel data (GPS point) of the CF to Shapefile and Display XY point Delineate Area of CF Block Division Sample Plot Layout Preparation of Final CF Map and export as PDF and/or JPEG format

Entrepreneurship Development

Total hours: 195
Theory: 117 **Full Marks: 100**
Practical: 78

Course Description:

This elective course intends to give exposure to student practically in identification and prioritization of timber and non-timber based enterprises. At the end of this course, students will be able to identify and prioritize forest based enterprise including timber and NTFPs in respective areas, prepare a comprehensive enterprise development business plan and its implementation in coordination and linkages with different line agencies.

Course Objectives:

- Identify major forest products such as NTFPs and timbers of different ecological zones of Nepal.
- Prepare a list of major forest based enterprises and prioritize it to develop enterprise.
- Prepare a comprehensive enterprise development business plan and implement it in coordination and linkages with various line agencies.

Text and reference Books

- Lecup, I. and Nicholson, K. (2000) Community -Based tree and Forest Product Enterprises: Market analysis and Development, FAO Rome Italy.
- Pandit, B.H., Albano, A. and Kumar, C. (2008) Improving Forest Benefits for the poor: Learning from community- based forest enterprises in Nepal, Center for International Forestry Research (CIFOR), Bogor, Indonesia.
- MEDEP (2008) Micro-enterprise development guidelines and strategy developed by the MEDEP of the United Nations, Lalitpur Nepal.
- Kollmair, M *et al* (2011) Pro-poor Value Chain Development for High Value Products in Mountain Regions: Indian Bay Leaf, ICIMOD, Lalitpur Nepal.
- MOI/GON (2067) Policy on Industrial Development in Nepal, Ministry of Industry, GoN Kathmandu Nepal.
- NAF (2016) Medicinal and Aromatic Plants Domestication Hand Book developed by Nepal Agroforestry Foundation, Koteshwor Kathmandu Nepal.
- Poudel, M. R. (2071) Business Economics, M.K. Publishers & Distributors, Kathmandu Nepal.
- Joshi, M.R, Pandit, B.H, Amatya, S.M and Dhakal, B. (2017) Agroforestry and Entrepreneurship Development Training Manual, Nepal Agroforestry Foundation Koteshwor Kathmandu Nepal.

Course Contents

Course: Forest Entrepreneurship Development (Theory hours 117 and practical hours 78)	
Unit 1: Introduction to Entrepreneur and Enterprise	**Hrs. theory 15**
Objectives	**Content**
Define entrepreneur, enterprise and list different types of enterprises and discuss about the feasibility study of an enterprise.	• Definition of entrepreneur • Characteristics of successful entrepreneur • What is enterprise • Types of enterprises based on Industrial Policy 2067 • Micro-enterprise and types of micro-enterprises • Phases of enterprise development • Policy and legal issues of forest based enterprises • Community forest user group (CFUG) level issues and constrains of an enterprise • Case study of a forest based enterprise
Evaluation Methods: Written tests, Home assignments and presentation, participation/ interaction in class.	Teaching/Learning activities and resources: classroom instruction, power points presentation, illustrations, diagrams, visuals, textbooks and reference books, Journals and publications.
Unit 2: Forest based enterprise identification and prioritization	**Theory hrs: 15**
Objectives	**Contents**
Identify and prioritize forest based enterprises and enterprise development modalities.	• Feasibility study of forest based enterprises - Sensitivity and risk analysis - Market analysis - Technical analysis - Economic analysis • Identification and prioritization forest based enterprises and criteria (Need and interest of entrepreneur/farmer, available resources, possibilities of selected technology implementation, investment resource availability, sponsorship or support availability, technical aspects – farmer's skill and knowledge, physical infrastructure, beneficiaries groups, market demand, government policy and labour availability etc) used for enterprise prioritization • Enterprise operating modalities such as community forest user group level, group

	based, individual and public private partnership (PPP) etc • Problems of group based enterprises • Issues and constraints or problems of forest based enterprise and its markets in Nepal
Evaluation methods: Supervision, field report and written test.	Teaching / learning activities & resources: Class room discussion, power point presentation, field visit, practice in field, attachment with projects, involve in usual activities
Unit 3: Value chain of forest product based enterprises	**Theory Hrs 20**
Objectives	**Contents**
Explain the value chain of forest based enterprises and discuss about the actors of value chain and income and employment of wood and non-wood enterprises.	• Concept and definition of value chain • Value chain model • Value chain mapping • Actors of value chain • Value Chain Analysis**Error! Bookmark not defined.** and its steps • Source of information needed for Value Chain Analysis**Error! Bookmark not defined.** • Income and employment generated by value chain in wood and non-wood (NTFP) enterprises • Impacts and importance of value chain in forest based enterprises • Markets of forest propducts (local, district, provincial, national and international markets) and its actors
Evaluation methods: Supervision, field report and written test.	Teaching / learning activities & resources: Class room discussion, power point presentation, field visit of wood and non-wood enterprises, practice in field, attachment with projects, involve in usual activities
Unit 4: Economic analysis of an enterprise	**Theory hrs:25**
Objectives	**Contents**
Explain the basic principle of economic analysis of an enterprise and discuss about economic evaluation criteria.	• Economic analysis of an enterprise • Interest and its types • Cost and its types • Calculation of values of profitability (Gross income or return, net income, net return, cost and benefit ratio, discount value, breakeven point, return of the investment and investment recovery period

	• Definition of Net Present Value (NPV) and Internal Rate of Return (IRR)
Evaluation methods: Supervision, field report and written test.	Teaching / learning activities & resources: Class room discussion, field visit of wood and non-wood enterprises, practice in field, attachment with projects, involve in usual activities
Unit 5: Business planning	**Theory hrs:25**
Objectives	**Contents**
Define the business plan, discuss about the elements of business and methods for preparing a business plan of forest based enterprises and finally develop a business plan of a wood or non-wood enterprise.	• What is business plan • Importance of business plan • Users of a business plan • Elements of a business plan • Contents of a business plan • Method for preparing business plan**Error! Bookmark not defined.** • Wood or non-wood (NTFP) based business plan preparation and presentation
Evaluation methods: Supervision, field report and written test.	Teaching / learning activities & resources: Class room discussion, power point presentation, field visit of wood and non-wood enterprises, practice in field, attachment with projects, involve in usual activities
Sub unit 6 : Enterprise establishment and management in coordination and linkages	**Theory hrs 17**
Objectives	***Contents***
Explain about enterprise registration, its implementation issue and challenges and discuss about the role coordination and linkages for enterprise development and management	• Enterprise registration process and practices • Issues and challenges for an enterprise establishment and management • Define of coordination and linkages • Importance of coordination and linkages for enterprise development and management • Identification of stakeholders such as local, district, provincial and national stakeholders (Venn diagram) for better coordination and linkages • Sustainable development of an enterprise
Evaluation methods: Supervision, field report and written test.	Teaching / learning activities & resources: Class room discussion, Power point presentation, field visit of selected wood and non-wood enterprises, practice in field, attachment with projects, involve in usual activities

Entrepreneurship Development -Practical

Forest Entrepreneurship Development	**Practical hours: 78**
***Practical 1:* Identify and prioritize timber and non-timber enterprises.**	***Practical hours: 10***
Objectives:	*Content:*
• Field practice to identify and prioritize timber and non-timber enterprises.	• Identify and prioritize timber and non-timber enterprises based on criteria such as need and interest of entrepreneur/farmer, available resources, possibilities of selected technology implementation, investment resource availability, sponsorship or support availability, technical aspects – entrepreneur/farmer's skill and knowledge, physical infrastructure, beneficiaries groups, market demand, government policy and labour availability giving score 1-5 based possibility of enterprise to be implemented • Select high scoring enterprises
Evaluation methods: Supervision, field report and written test.	Teaching / learning activities & resources: Work in forest based enterprise or industry to enhance skills, practice in field
Practical 2: Value chain study in forest based enterprise development and management.	**Practical hours: 10**
Objectives	**Content**
• To discuss and learn about the importance of value chain study in forest based enterprise development and management.	• Field visit to learn the importance value chain study to operate a forest based enterprise.
Evaluation methods: Supervision, field report and written test.	Teaching / learning activities & resources: Work in forest based enterprise or industry to enhance skills, practice in field.
Practical 3: Preparation of business plan of a forest based enterprise	**Practical hours: 28**
Objectives	***Content***
• To learn and practice about forestry business plan preparation and implementation.	• Visit forest based enterprises. • Develop business plan of an enterprises to be operated from wood and non-wood (NTFP) forest products
Evaluation methods: Supervision, field report and written test.	Teaching / learning activities & resources: Work in forest based enterprise or industry to enhance skills, practice in field

Practical 4: Enhance knowledge and practical skills on registering and operating a selected wood or non-wood enterprise and empower on coordination and linkage process	**Practical hours: 30**
Objectives	***Contents***
• To enhance knowledge and practical skills on operating a selected wood or non-wood enterprise. • To empower on coordination and linkage process	• Enhance knowledge and practical skills on registering and operating a selected wood or non-wood enterprise. • Enhance skill on coordination and linkages to operate an enterprise
Evaluation methods: Supervision, field report and written test.	Teaching / learning activities & resources: Field visit of forest based enterprise or industry and GON offices to enhance skills, practice in field, attachment with projects, involve in usual activities

Office Management

Total hours: 78 **Full Marks: 50**

Course description
This course deals with the Accounting and Office Management. It gives Government Fiscal Administrative Procedure, Official Procedures and Financial Rules and Regulations.

Course objectives
The students will gain general knowledge about the principles and practices of, budgetary system, fiscal administration, accounting system of Nepal Government, at the end of the course, the students will be able to:

- Explain the implementation and procedures of budgetary and accounting systems of Government of Nepal.
- Explain the practices of official correspondence, filing, and indexing systems
- Explain the financial rules and civil servants code of Government of Nepal.

Reference books:

- Sharma, Narendra et.al., Principles of Accounting-XI, Bundipuran Prakashan, Kathmandu
- Koirala, Yadav Raj et.al., Principles of Accounting-XI, Asmita Books Publication, Kathmandu
- Shrestha, Dasharaha et.al., Accountancy-XI, M.K. Prakashan Kathmandu
- Khanal, Soma Raj, Surendra Thapa Aslami and Sitaram Dhakal. Business Studies. Kathmandu: Taleju Prakashan, .
- Pant, Prem R., et al. Business Studies. Kathmandu: Buddha Academic Publishers and Distributors Pvt. Ltd.
- Shrestha,Kul Narsingh Office Organization and Management -Nabin Prakashan Bhotahity , Kathmandu
- Nijamati Sewa Ain and Nijamati Sewa Niyamawali, Publisher: Ministry of Law and Justice, NG. Management Committee of Legal Books.
- M.L Pradhan & S.P Munamkarmi Accountin System of NG,. Publisher: Eductional Enterprises.
- Financial Procedures Act .2055 (1999) Govenment of Nepal.

Course Contents

Accounting and Office Management	**Theory Hrs: 78**
Unit 1: Accounting	**Theory hrs: 36**
1.1: Government Accounting	**Theory hrs: 7**
Objectives :	**Content :**
• Explain meaning and defination , history, objectives , importance and features of government accounting system of Nepal	• Meaning and defination of government accounting. • Features of government accounting • Objectives of government acounting • Origin and growth of government acounting in Nepal.

	• Accounting System used in Nepal. Wasil Banki Sreshta Pranali Syaha Sreshta Pranali Faram Sreshta Pranali Bhuktani Sreshta Pranali • Difference between government and commercial accounting
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
1.2: New Govt. Accounting System	**Theory hrs: 7**
Objectives:	***Content:***
• Explain meaning and defination, history, objectives, importance and features of new government accounting system.	• Introduction • Historical background of government accounting system in Nepal. • Objectives of new government accounting system • Importance of new accounting system • features of new government accounting system • Limitation of new government accounting system
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
1.3: Classification of government accounting and Major accounting types and ledgers	**Theory hrs: 8**
Objectives:	***Content:***
• Explain classification of government accounting • Introduce different types of accounting ledgers and forms used by the government of Nepal.	• Central level accounting • Operating level accounting • Differcences betwen central level accounting and operating levle accounting • Classification of expenditures Consuption expenditure Office operation and service expences Grants • Forms used in new accounting system Primary forms Accounts or Ledger Forms for Reports Mescellaneous Forms Petty cash and petty cash book • Meaning

	• Needs and Importance of petty cash
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
1.4: Government Budget Formulation Procedure	**Theory hrs: 7**
Objectives:	***Content:***
• Introduce historical backgrounds, definitions, and objectives, importance and function of the government budget. • Explain procedures of government budget formulation.	• Meaing and concept of government budget • Importance of budget • Objectives of budget • Function of budget • Procedures of government budget formulation
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
1.5: Inventory Accounting Procurement System and store keeping	**Theory hrs: 7**
Objectives:	***Content:***
• Introduce meaning, objectives inventory accounting • Explain procedure of government procurement system..	• Meaning, objectives inventory accounting • Classification of inventory goods • Government procurement system • Material purchasing and receiving procedure Purchase requisition Quotation or tender for purchase Purchase order Material receiving and inspection Checking and forwarding for payment • Meaning of store keeping • Objects of store keeping • Types of store • Location of store • Factors to be considered for selecting location of store • Store Keeping procedure Classification and codification of materials Recording of materials received Issuing of materials

	• Recording of materals received Bin card Store ledger
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 2: Concept of general office management	**Theory hrs: 25**
2.1: Office management in general	**Theory hrs : 5**
Objectives :	Content
• Explain concept , function and impotance of an office and office management	Concept of an office Functions of an office Importance of office concept of office management Importance of office management
• Explain the organogram of ministry of forest and environment and their departments	Organizational structure of Ministry of Forest and Environment and their departments in general
2.2 Filing and Indexing	**Theory hrs :8**
• Explain concept, purposes and importance of filing and indexing. • Explain types of filing and indexing system.	• concept of filing • purposes of filing • Importance of filing • qualities of good filing system • Types of filing system Traditional filing system Modern filing system **Indexing** Concept of indexing Purposes of indexing Importance of indexing Qualities of good indexing Types of Indexing
2.3: Records Management	**Theory hrs : 6**
Objectives	content
• Explain concept, importance of records management. • Explain importance and procedure of records retention.	• Concept of and types of records • Concept of records management • Importance of records management • Principal of records management • Retention of records • Importance of records retention • Procedure of records retention • Disposal of records
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books

2.4: Official Correspondence	**Theory hrs: 6**
Objectives	Content :
• Explain the general official procedures in reference with government of Nepal.	• Meaning of official correspondence • Importance of correspondence • Essential qualities of correnspondence • structure of an official lettes • Tippani (decision making procedures), • ,Draft of tippani
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 3: Financial Rules and Regulations	**Theory hrs: 7**
Objectives:	***Content:***
• Explain the financial rules and procedures in reference with government of Nepal.	• System of of salary and wages payment • Meaning and defination of salary and wages • Differences between salary and wages • Principal method of wage payment • Fatures of good payment system of wages • Daily allowances and traveling allowances • Advance and contracts
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
UNIT 4: Civil Service Act and Regulations	**Theory hrs: 10**
Objectives:	***Content:***
• Explain major features of civil service act and regulations.	• Objective • Major features of civil service act and regulations Constitution of civil services Vacancy and its fulfillment in civil service Salary and allowances Attendance and leave
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books

Work Experience Program (WEP)

Total: 546 hrs
Theory: 0 hrs
Practical: 546 hrs
Duration: 14 hrs/week (546 hrs) **Full marks 200**

General description
This course intends to provide hands on skills through field observation and work practices in the different fields in Nepal. This field works normally will focus on the area of community forestry, soil conservation and watershed management, wildlife and protected area management and forest-based entrepreneurship development for the period of 3 months (±90 days) in two different modules (Modules-I and II) that to be followed as given below.

Evaluation system:
The student's performances will be evaluated based on their training /field work performances in the field, and for that the weightage for the evaluation will be as following:
Final-50% (100 marks), Training/ field supervisor -25% (50 marks) and host organization-25% (50 marks)

Host Organization is referred as any government and non-government organization having implementation experiences of similar programs for at least 3 years. The host organization should have at least B.Sc. Forestry or equivalent graduates to assign as examiner for this purpose of field based students evaluation.

The implementing institution is required to identify the host organization, submit detail field program activity plan to the proposed host organization and get approval/acceptance from them or if necessary, should have formal agreement with them prior to field visit for this module.

A.	**WEP- Module-I:**			
S.N.	Activities to be performed	Duration	Student's evaluation by host organization Full Marks-50	Evaluation methods
1.	Orientation and Preparation about intensive field work (General orientation, information collection (matter and materials)	4 days	-	-
2.	***Intensive Field work on Community Forestry:*** *Priority area* • Forest Survey and Resources Information Collection Techniques (Boundary Survey and Forest Inventory) • CF Boundary Survey- Preparation of Map, Area calculation • CF Inventory- Volume Calculation- Calculation of the growing /Ha. MAI /ha/year- Annual Allowable Cut. /ha/year • Socio-economic data collection techniques in a community forest. (Demand and dependency on Forest Products- Need, interest, problems and opportunities • Prepare a constitution of a community forest user group	20 days	Full marks- 12.5	Host organization can use their own evaluation methods

	• Familiar with data Analysis techniques of collected forest resources information to prepare CF operational plan. • Aware on content of CF operational plan and process of CF operational plan preparation. • Rapport building with CFUG members • Prepare a draft CF operational Plan • CF hand over process/meeting and assembly • Expose on a Different monitoring and evaluation methods in community forestry			
3.	***Intensive Field work on Soil Conservation and Watershed Management:*** *Priority area* • Observation and identification of soil profiles in different fields • Field visit to study exiting measures for soil conservation • Preparation of a sample vegetative measures for soil conservation- Exercises in field sites • Field visit the places of Bio-engineering / mechanical methods for soil conservation • Check dam/retaining wall/ Terraces (design and costing) and construction practice • study of exiting vegetative measures for soil conservation • Field visits Biophysical/Socioeconomic data collection • Field visit to study the existing land use plan of an area • Preparation of a sample land use plan of an area • Process and methods of Community based micro- watershed plan preparation • Exposers on landslide and flood affected areas. • Practices on slope stabilization methods	12 days	Full marks- 12.5	Host organization can use their own evaluation methods
4.	***Intensive Field work on Forest based Enterprises (Entrepreneurship Development)*** *Priority area* • Visit forest based micro enterprises (NTFPs, MAPs, Timber, Paper, handicrafts) and develop the concept and ideas of entrepreneurship development in the field. • Timber/NTFPs and MAPs processing and value addition • The process of business prioritization/ feasibility study and preparation of business plan (scheme) of an enterprise. • Process of enterprise registration as per the Nepalese Act • Problems, constraints and opportunities in forest based enterprise development in district that visited • Products and marketing	12 days	Full marks- 12.5	Host organization can use their own evaluation methods

5.	***Intensive Field work on Wildlife and Protected area Management:*** <u>*Priority area*</u> • Listing of major wild life species available in the NP/WR (Mammals, Birds, Reptiles)and discussions and sharing about their conservation status • Different wildlife census techniques • Population estimation in fields (Transect survey, road side count, Pellet-group counts, Antler count, Nest count). • Exercise on bird watching/ Circular point bird count • In-situ/Ex-situ conservation of wild life • Parks people relation ships • Belt identification for belt transect-identification of wildlife sign and symptoms • Agreesive behabiours of carnivores and mega herbivores, human behabiour to adjust the field situations and minimize the potential incidents • Problems and constraints of wild life management in Nepal (local issues)	12 days	Full marks- 12.5	Host organization can use their own evaluation methods
	Sub total	**± 60 Days**		
B.	***WEP-Module-II:***			
1.	*Literature review and secondary information collection on CF, W/L mgt, soil; conservation and enterprises*	3 days	-	-
2.	Field data compilation/analysis and draft report preparation	5 days	-	-
3.	Report submission to college supervisor for correction and feed backs	10 days		
4.	Field report presentation practice (40 students) (8 x 5 days = 40)	5 days	-	-
5.	Report finalization , printing, binding and submission to the college	7 days	-	-
	Sub total	***± 30 days***	-	-
	Total days (Module-I + Module-II)	**± 90 days (3 months)**		

Experts Involved in Curriculum Revision Process

SN	Full Name	Designation	Organization
1.	Mr. Chiranjivi Pd. Pokharel	Project Manager	National Trust for Nature Conservation
2.	Mr. Bidur Koirala	Instructor	Kathmandu Forestry College
3.	Mrs. Januka Adhikari	Programme Officer	Kathmandu Forestry College
4.	Mr. Krishna Ram Bhattarai	Scientific Officer	Department of Plant Resources
5.	Mr. Umakant Lal Karna	Lecturer	Kathmandu Engineering College
6.	Mr. Yadav Gaire	Lecturer	Kathmandu Engineering College
7.	Mr. Basudev Jha	Under Secretary	Forest Research and Training Center
8.	Mr. Hari Bhadra Acharya	Under Secretary	Department of National Parks and Wildlife Conservation
9.	Mrs. Leena Sah	Faculty	Kathmandu Forestry College
10.	Mr. Baikuntha Pd. Khanal	Associate Professor	Tribhuvan University
11.	Ms. Kamana Panta	Visiting Faculty	Kathmandu Forestry College
12.	Mr. Prakash Sayami	Visiting Faculty (Ex. DG)	Department of Plant Resources
13.	Mr. Puran Bhakta Shrestha	Visiting Faculty	Kathmandu Forestry College
14.	Mr. Shiva Sharma Paudel	Faculty	Kathmandu Forestry College
15.	Mr. Shiva Shankar Neupane	Programme Coordinator	Kathmandu Forestry College
16.	Mr. Shyam Pd. Sharma	Visiting Faculty	Kathmandu Forestry College
17.	Mr. Sanjeev Bhattarai	Lecture	Kathmandu Forestry College
18.	Mr. Arun Sharma Poudyal	Programme Coordinator	Kathmandu Forestry College
19.	Mr. Gopal Kumar Shrestha	Ex. Director General	Department of Forest
20.	Mr. Prashid Kandel	Instructor	Kathmandu Forestry College
21.	Mr. Murari Raj Joshi	Instructor	Kathmandu Forestry College
22.	Mr. Krishna Hari Maharjan	Instructor	Kathmandu Forestry College
23.	Mr. Jhamak Bdr Karki	Vice Principal	Kathmandu Forestry College
24.	Mr. Ambika Prasad Gautam	Principal	Kathmandu Forestry College
25.	Ms. Prativa Pandit	Faculty	Kathmandu Forestry College