CURRICULUM

DIPLOMA

In

Forestry

(I.Sc.Forestry)

Council for Technical Education and Vocational Training

Curriculum Development Division

Sanothimi, Bhaktapur

First revision, 2013

Table of Contents

1. Introduction:

This curriculum is based on the development of both effective and efficient forestry service providers as professionals for fulfilling the present forestry needs of people with its socio-cultural impacts on national and community forest management. The approach will focus 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 etc.

This field has been helping the world for the overall development and it has been creating wage and self employment opportunities both in public and private sectors. This curriculum is designed with the purpose of producing middle level forestry technical human resources required for livelihood improvement of community through the participatory methods in association with the community forestry user groups.

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 etc.

2. Course title:

Diploma in Forestry (I Sc. Forestry)

3. Programme objectives:

This curriculum has following objectives to:

- Prepare forestry technicians who are able to work as ranger in different level of forestry related government and nongovernment organization;
- Produce quality human resources to provide technical and managerial services in public and private forests as well as protected Areas
- Develop competency in forestry enterprises
- Provide extensive field based experiences to meet specific and growing needs of different forestry stakeholders

4. Programme description:

This course is based on the job required to be performed by a middle level forestry technician in different forestry institutions of Nepal. The **Diploma in Forestry** 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 Field Practice.

The foundational subjects like Physics, Chemistry, Zoology, Botany and Mathematics being offered in diffusion model of curricular programme 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 are 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.

5. Duration:

The total duration of this curricular program is three years. One academic year consists of maximum of 39 academic weeks, and one academic week consists of maximum of 40 hours.

6. Target group:

The target group for this programme will be all interested individuals who passed School Leaving Certificate (SLC) with English, Science, and Mathematics or equivalent and related Technical School Leaving Certificate (TSLC).

7. Group size:

The group size will be maximum of 40 (Forty eight) in a batch.

8. Target location:

The target location will be all over Nepal.

9. Entry qualification:

Entry qualification of the applicant for diploma in biomedical engineering programme should be SLC pass or equivalent or Technical SLC (TSLC) in related subject. S/he should have English, Science, and Compulsory Mathematics in SLC or as per provisions mentioned on CTEVT admission guidelines.

10. Entry criteria:

- Should submit SLC or equivalent certificate
- Should pass entrance examination as administered by CTEVT

11. Selection:

Applicants fulfilling the entry criteria will be selected for admission on the basis of merit.

12. Medium of instruction:

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

13. Pattern of attendance:

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

14. Teacher and student ratio:

- For theory: As per the nature of the course
- For practical / demonstration: 1:10
- For bench work: 1:8

15. Teachers and demonstrators:

- The disciplinary subjects' related teachers should be a bachelor's degree holder in the related area with three years experience in the related field.

- The demonstrators should be bachelor's degree holder in the related area with two years experiences in training activities.
- The foundational subjects' related teachers should be master's degree holder in the related area.

16. Instructional media and materials:

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

- ***Printed Media Materials*** (Assignment sheets, Case studies, Handouts, Information sheets, Individual training packets, Procedure sheets, Performance Check lists, Textbooks etc.).
- ***Non-projected Media Materials*** (Display, Models, Flip chart, Poster, Writing board etc.).
- ***Projected Media Materials*** (Opaque projections, Overhead transparencies, Slides etc.).
- ***Audio-Visual Materials*** (Audiotapes, Films, Slide-tape programs, Videodiscs, Videotapes etc.).
- ***Computer-Based Instructional Materials*** (Computer-based training, Interactive video etc.).

17. Teaching learning methodologies:

The methods of teachings for this curricular program will be a combination of several approaches. Such as Illustrated Lecture, Tutorial, Group Discussion, Demonstration, Simulation, Guided practice, Practical experiences, Fieldwork, Report writing, Hospital visit, Term paper presentation, Case analysis, Tutoring, Role-playing, Heuristic, Project work and Other Independent learning.

- Theory: Lecture, Discussion, Seminar, Interaction, Assignment, Group work.
- Practical: Demonstration, Observation, Guided practice, Self-practice, Project work, Industries practice

18. Mode of education:

There will be inductive and deductive mode of education

19. Examination and marking scheme:

a. Internal assessment

- ❖ There shall be a transparent evaluation system for each subject both in theory and practical exposure.
- ❖ Each subject will have internal evaluation at regular intervals of 4 months including formal and informal evaluation approaches and students must get the feedback about it. (Weightage of theory and practical marks will be 20% and 40% respectively.)
- ❖ The theoretical and practical assessment format must be developed and applied by the evaluators for evaluating student's performance in each subject related to the theoretical and practical experiences.

b. Final examination

- ❖ Weightage of theory and practical marks will be 80% and 60% respectively
- ❖ Students must pass in all subjects both in theory and practical to qualify for certification. If a student becomes unable to succeed in any subject s/he shall appear in the re-examination as administered by CTEVT.
- ❖ Students shall be allowed to appear in final examination only after completing the internal assessment requirements.

c. Requirements for final practical examination

- ❖ Qualified forester/relevant subject teacher must evaluate final practical examinations.
- ❖ One evaluator in one setting can evaluate not more than 20 students in a day.
- ❖ 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 an external evaluator nominated by CTEVT.

20. Provision of back paper:

There will be the provision of back paper but a student must pass all the subjects of all three years within six years from the enrolment.

21. Disciplinary and ethical requirements:

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

22. Pass marks:

The pass marks for theory and practical examinations are:

- ❖ 40% in theory examination
- ❖ 60% in practical examination

23. Grading system:

The overall achievement of each student will be measured by a final aggregate percentage of all final semester examinations and graded as follow: -

The following grading system will be adopted:

- ❖ Distinction: 80% and above
- ❖ First division: 65% to below 80%
- ❖ Pass division: 40% in theory and 60% in practical

(Pass aggregate to below 65%)

24. Certification and degree awards:

- Students who have passed all the components of all subjects of all three years are considered to have successful completion of the course.
- Students who have successfully completed the course will be awarded with a degree of **Diploma in Forestry (I. Sc. Forestry)**

25. Academic and career paths:

The graduates would also be eligible to apply for the entrance examination administered by the Institute of Forestry (IOF) to study Bachelor's degree in forestry under Tribhuvan University and similarly they will be eligible for the position equivalent to Non-gazetted 1st class (technical) as Ranger or as prescribed by the Public Service Commission of Nepal. The graduate will be eligible for registration with the related Council in the grade as provisioned in the related Council Act (if any).

Course Structure of 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 for Forestry	3	2	5	16	64	3	8	12	3	100
5	Chemistry for Forestry	3	2	5	16	64	3	8	12	3	100
6	Zoology for Forestry	3	2	5	16	64	3	8	12	3	100
7	Botany for Forestry	3	2	5	16	64	3	8	12	3	100
8	Mathematics and Statistics	3	2	5	16	64	3	8	12	3	100
9	Forest Surveying and Engineering	3	2	5	16	64	3	8	12	3	100
Total		**28**	**10**	**40**							**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	16	64	3	8	12	3	100
2	Wildlife and Protected Area Management	3	2	5	16	64	3	8	12	3	100
3	Integrated Watershed Management	3	2	5	16	64	3	8	12	3	100
4	Community Forestry	3	2	5	16	64	3	8	12	3	100
5	Forest Measurement	3	2	5	16	64	3	8	12	3	100
6	Forest Management	3	2	5	16	64	3	8	12	3	100
7	Forest Harvesting and Utilization	3	2	5	16	64	3	8	12	3	100
8	Agroforestry	3	2	5	16	64	3	8	12	3	100
Total		**24**	**16**	**40**							**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	16	64	3	8	12	3	100
2.	Non-Timber Forest Products(NTFPs)	3	2	5	16	64	3	8	12	3	100
3.	Forestry Extension	3	2	5	16	64	3	8	12	3	100
4.	Forest Policy, Law and Office Management	2	-	2	10	40	1.5	-	-	-	50
5.	Computer Application	2	2	4	10	40	1.5	20	30	3	100
6.	Entrepreneurship Development	3	2	5	16	64	3	8	12	3	100
7.	Field Practice	-	14	14	-	-	-	-	-	-	200
	Total	**16**	**24**	**40**							**750**

First Year

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 the practical skills in using a dictionary and equips them with the knowledge of basic structures of English language. 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 a dictionary effectively.
- 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.

Minimum Standards

Students must achieve a minimum of 40% in theory.

Recommended Textbooks

1. CDC (1997) Link English. Kathmandu : Sajha Prakashan, Kathmandu.
2. Doff A., C. Jones and K. Mitchell (1997) Meanings into Words. Cambridge : CUP
3. Student's book
4. Workbook
5. Lohani, S.P. and R.P. Adhikary (1997) The Magic of Words, Kathmandu : M.K. Publishers

Unit 1: Using a dictionary	**Theory Hrs.** **15**
Objectives	Contents
Use a dictionary effectively.	Alphabetical order Saving time Guide- words Dictionary entry Checking spelling Words often confused Finding the meaning Finding idioms and phrasal verbs
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.** **82**
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 Jobs and routine Describe people's jobs Talk and ask about daily routine Talk and ask about regular events	Compound noun phrases Present simple question forms Adverbs and phrases expressing general frequency Phrases expressing precise frequency Present simple passive with 'be' or 'get' Vocabulary: jobs and places of work
2.4 Direction Say what directions things and people move in Give instructions for making and doing things Give street directions	Prepositions of directions Expressions for maintaining a sequence in giving instructions Expressions for giving street directions
2.5 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
2.6 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
2.7 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'
2.8 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

2.9 Comparison Compare objects and actions	Structures for comparison involving adjectives, adverbs and verbs Superlative forms
2.10 The past and the present Talk about past habits and states Remember the past Talk about recent changes Compare the past and present	`Used to' Remember + v-ing Remember + a clause `Not ...any more/longer' Present perfect passive Time comparison
2.11 Likes and dislikes Express likes and dislikes State preferences	Active and passive gerund forms `Prefer' `Like' and `dislike' verbs
2.12 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
2.13 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
2.14 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
2.15 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

2.16 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
2.17 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'
2.18 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
Unit 3: Extensive Reading and Writing	Theory Hrs. 59
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 (IsaacAsimov) 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 मुख्यतः 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 सामान्यवाध 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 प्रयुत्तः 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

पूर्णाङ्क : ५०

पाठघण्टा :८०

एकाइ	पाठ्य विषयको विवरण	पाठ घण्टा	अंक
१.	**वर्ण र वर्णविन्यास**	**२०**	**१०**
	क) उच्चार्य वर्णहरुको परिचय :स्वर र व्यञ्जन वर्णहरु देवनागरी लिपि र उच्चार्य नेपाली वर्णहरु नोपाली अक्षरहरुको संचरना	१०	५

	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	५
२.	**शब्दवर्ग, शब्दरुपायन र शब्दनिर्माण**	**३१**	**२०**
	क) शब्दवर्ग- नाम, सर्वनाम विशेषण, क्रियापद, नामयोगी, क्रियायोगी, संयोजक, विस्मयाधिवोधक र निपातहरुको पहिचान- अभ्यास ।	६	५
	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	५
	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 वहूव्रीहिको प्रक्रियावाट समस्त शब्दहरुको निर्माण गर्ने अभ्यास : पुर्ण आंशिक र अपरिवर्तित द्वित्व-प्रक्रियावाट शब्दनिर्माणको अभ्यास वन विज्ञान सम्बन्धी प्राविधिक शब्दहरुको ज्ञान, अभ्यास, अर्थ लेख्ने र अर्थ खुल्नेगरि वाक्यमा प्रयोग गर्ने । अम्ल वर्षा, कृषिवन, वायुपरागसेचन, सपुष्पक, फँडानी, स्वपोषित, वृद्धिवर्धक, काई (हरितमल), जैविक विविधता, जिवोर्जा, व्रण, छत्र तह, छत्रवरण, वितानाच्छादित, जलाधार, हरितकरण, उडुवा, सरपट कटान, सहाधिरोही, सामुदायिक वन, विधान, समोच्च रेखा, प्रसृतलता, छत्राग्नि, अपुष्पक, अवतारण, अवशेष, पतझर, विखण्डन, पत्रावतारक, निरावरण, अनाच्छादन, विविधता, प्रवल, अधिरोही रुख, बगाहन, दरियाबुर्दी, सुखड, परिस्थितिक प्रणली, पारितन्त्र, अतिक्रमण, संङ्कटापन्न, रैथाने, कीटविज्ञान, परारोही, वाष्पोत्सर्जन, विलोपन, लोपहुनु, सुखड, जनन्क्षमता, निषेचन, उर्वरक, अग्निरेखा, खाद्य-स्तूप, घाँट गद्दी, जीवाश्म, अनुवंश, बीजाङ्करण, भू-आवरण, वृद्धि रेखा, वृद्धिचक्र, अपुष्पक, वासस्थान, कठोरीकरण,छायार्थी, उद्भिज, शाकाहारी, बागवानी, परपोषी, वर्णशङ्कर, अभिवृद्धि, कीटाहारी, अन्तररोपण, तहकिकात, भू- स्वमित्व, भू- आकृति, भूस्खलन, निक्षालन, पणदद्रु, पर्णरेखा, प्रकाशार्थी, अनुदैर्ध्य भाग, छपान, वनमापन, मिश्रित वाली, अनुगमन, एकेन्द्रीय, उत्प्रेरणा, छादन, सहजीवन, निकेतन, खोपी,	१९	१०

	उद्यान/बगैंचा, चरिचरन, पुष्पद्भिद्, दीप्तिकालिक, प्रकाशसंश्लेषण, प्रकाशानुवर्ती, प्रकाशानुवर्तन, पादप-प्लबक, परिवहन, परागसेचन, परभक्षि, छिमल्नु, दुर्लभ, आरक्ष, जडकेश,लाथ्रा, संशोषण, अवसादन, निष्पतन, अवस्रवण, छायार्थी, मृद्वायु, मृदारास, मृज्जीवी, प्रजाति, चाङ्ग, झँकशिर,अनुक्रमण, सर्वेक्षण, सहजीवन, सहजीविता, टङ्गिया, प्रादेशिकता, छटनी,उत्स्वेदन, वृक्ष-रेखा, अधस्थ वृक्ष, बंजर, जलाधार, अपक्षय, अरण्याभूमि, मरुद्भिद्, प्राणीप्लवक		
३	**बाक्य तत्व बाक्यान्तरण र अनुच्छेद- रचना**	२९	२०
	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, द्वारा, को, का, की, रो, रा, री, नो, ना, नी, मा आदि विभक्ति प्रयोगको अभ्यास सरल र तिर्यक् विभक्तिनियमको अभ्यास	७	५
	ख) वाक्यान्तरण: १) विभिन्न, काल, पक्ष, भाव, अकरण, वाच्य, प्ररणर्थक आदिमा वाक्यान्तरण गर्ने अभ्यास २) वाक्य-सश्लेषण र विश्लेषणको अभ्यास	७	५
	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	१०

द्रष्टव्य :

२० प्रतिशत अङ्क आन्तरिक मूलयाङ्कनका लागि छुट्याईएको छ । यो पाठ्यांशको शिक्षणमा एउटा कक्षाको विद्यार्थी संख्या ४० मात्र हुनेछ ।

सहायक पुस्तकहरु (सम्बद्ध अंश मात्र)

मोहनराज शर्मा, शब्दरचना र वर्ण विन्यास वाक्यतत्व र अभिव्यक्ति, काठमाण्डौ वुक सेन्टर, काठमाण्डौ. ।

चित्र कुमार गुरुङ्ग एम्.एस्सी र केदार न्यौपाने, एम. ए. प्राविधिक शब्दार्थावली -चिकित्सा तथा विज्ञान खण्ड), त्रिभुवन विश्वविद्याालय, चिकित्सा शाश्त्र अध्ययन संस्थान, अनुसन्धान शाखा, महाराजगंज, काठमाण्डौं ।

हेमाङ्गराज अधिकारी, समसामयिक नेपाली व्याकरण, विद्यार्थी पुस्तक भण्डार, भोटाहीटी काठमाण्डौं

त्रि.वि. पाठ्यक्रम विकास केन्द्र, अनिवार्य नेपाली शिक्षण निर्देशन, काठमाण्डौ ।

लालानाथ सुवेदी र डा. हरि प्रसाद पराजुली, नेपाली वर्ण विन्यास, साझा प्रकाशन, ललितपुर ।

लालानाथ सुवेदी, अनिवार्य नेपाली अभ्यास पुस्तीका, टङ्कित सामग्री ।

खण्ड ख : बोध तथा अभिव्यक्ति

पाठघण्टा : ७६

पूर्णाङ्क : ५०

क्र.स		**प पाठ घण्टा**	**अङ्क**
१.	बोध र शब्द भण्डार गद्यांशहरुको वोध र शब्दभण्डारको अभ्यास संक्षेपिकरण :	१०	१०
२.	बुँदा, टिपोट गरी संक्षेपीकरण गर्ने अभ्यास अनुच्छेद लेखन ज्ञान विज्ञान र प्रविधिसँग सम्बन्धीत विभिन्न विषय शीर्षकहरुमा अनुच्छेद	७	५
३.	लेख्ने अभ्यास निवन्ध लेखन निवन्ध योजना र सो सँग सम्वन्धीत बुँदा अनरुप अनुच्छेद गठनको अभ्यास वस्तुपरक र भावपरक निवन्ध लेखनको अभ्यास	९	५
४.	कृति समीक्षा : विषयवस्तु, कथानक, पात्र, परिवेश, सन्देश, शीर्षक र भाषा शेलीका आधारमा निम्नलिखित रचनाहरुको समीक्षात्मक अभ्यास : कथा : गुरु पसाद मैनाली छिमेकी	१०	१०
५.	विश्वेश्वरप्रसाद कोइराला सिपाही भवानी भिक्षु हारजीत इन्द्र वहादुर राई रातभरी हुरी चल्यो रमेश विकल मधुमालतीको कथा निवन्ध : लक्ष्मी प्रसाद देवकोटा वीरहरु 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 : वालकृष्ण सम रणदुल्लभ विजय मल्ल वहुला कजीको सपना	४०	२०

द्रष्टव्य :

२० प्रतिशत अंक आन्तरिक मूल्याङ्कनका लागि छुट्याइएको छ । यो पाठ्याशंको शिक्षणमा एउटा कक्षाको विद्यार्थी संख्या ४० मात्र हुनेछ ।

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, र्टीधित सामग्री ।

५. गोरखापत्र, कान्तिपुर आदि पत्रिकाका सम्पादकीय, टिप्पणी र लेखहरु ।

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 arts and cultural achievements of Nepal.
- Explore the social problems challenging Nepal today.
- Analyze the salient features and difficulties of Nepalese economic development.
- Distinguish between democratic and non-democratic forms of government.
- Examine the features of the constitution of the Kingdom of Nepal, 1990.
- Identify the chief characteristics of Nepal's foreign policy.
- Describe Nepal's role in the peace-keeping efforts of the world.
- Summarize the political development in Nepal.

Minimum Standards

Students must achieve a minimum of 40% accuracy in theory.

References

- Faces of Nepal, Jagadamba Press.
- Bista, Dor Bahadur, People of Nepal
- Bista Dur Bahadur, Sabai Jalko Fulbari

Course: Social Studies	**Hrs. theory 78**
Unit: 1 Introduction	**Hrs. theory 10**
Sub-unit: 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. Identify the administrative units of Nepal. Compare the ecological, climactic, and regional diversities in Nepal. Describe the natural resources of Nepal.	Geographical locations, diversities, and unique characteristics of Nepal. Geographical divisions of Nepal: a. ecologic climactic rivers vegetation administrative Natural resources of Nepal (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: 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 Nepal: origin of the word Nepal ancient dynasties: Gopal, Mahispal, Kirat, Janak, and Sakhaya 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 and Yaksha 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.**
Unit: 2 Political History of Nepal	
Sub-unit: 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 just before the enthronement of Prithvi Narayan Shah. Analyse the policies adopted by Prithvi Narayan Shah and his successors during the time of unification. Identify the factors which influenced the rise of the Ranas.	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, Bahadur Shah, and Bhim Sen Thapa. Political instability and rise of Jang Bahadur: conspiracies, assassinations, Kot Massacre, Bhandarkhal Parva, Alau Parva
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion.**
Unit: 2 Political History of Nepal	
Sub-unit: Rana period and rise of democracy	**Hrs. theory 4**
Objectives	**Contents**
Explain the social, economic and administrative reforms of the Rana period. Analyse the anti-Rana movement and discuss the causes of the revolutions of 2007 B.S. Evaluate the democratic exercise of Nepal during 2007-2016 B.S. Assess the works of the first elected government of Nepal. Identify the characteristics of the panchayat	Reforms of the Ranas: social, economic, and administrative. Anti-Rana movement: Prachandra Gorkha Library episode Parja Parishad Nepali Congress Influencing factors of the revolution of 2007 B.S. Political instability and the election of 2015 B.S.;

system. Examine the people's movement of 2046 B.S. and its impacts. Summarize the characteristics of the constitution of the Kingdom of Nepal, 1990. Discuss the impact of recent political events on the social conditions of Nepal.	formation of Nepali Congress government and its reforms. End of multiparty system and rise of panchayat; characteristics of panchayat system. People's movement of 1990 A.D. and characteristics of the constitution of the Kingdom of Nepal 2046 B.S. The impact of recent political events on Nepali society.
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion.**
Unit: 3 People, Society & Culture	**Hrs. theory 14**
Sub-unit: Development of Nepalese culture and society	**Hrs. theory 7**
Objectives:	**Content:**
Analyze the population growth of Nepal: contributing factors and effects on society. Discuss the contributing factors and solutions to the chief social problems of Nepal. Describe the origin of the caste system in Nepal and current laws about cast practice. Discuss the establishment of our national language. Discuss the use of ethnic languages. Compare the different cultural habits of Nepal.	Population growth in Nepal, fertility, mortality, and migration. Development of different caste beliefs in Nepal and laws related to the caste system; History of development of our national language, other languages, and their literature: Nepali,Newari,Sanskrit,Maithili Social problems: Poverty,Gender issues,Unemployment Drug addictions,HIV/AIDS,Prostitution Child labor,Trafficking and Other Cultural heritages in Himalayan, Hilly and Terai regions: Food habits Dress and ornaments Festivals and temples Music, songs and dances Occupations

Evaluation methods: written exam	**Teaching / Learning activities and resources: classroom instruction and discussion, textbook self-study.**
Unit: 3 People, Society & Culture	
Sub-unit: Arts and religion	**Hrs. theory 7**
Objectives:	**Content:**
Analyze the cultural heritage of Nepal. Discuss the development of arts in Nepal. Explain the history of religious harmony in Nepal.	Art in Nepal: paintings, sculpture and architecture in ancient, medieval and modern times. Religions in Nepal: • Hinduism • Buddhism • Muslim • Kirat • Christian
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion.**
Minimum Standards: theory – 40%, lab 60 % accuracy by end of the course.	
Unit: 4 Nepalese Economy	**Hrs. theory 14**
Sub-unit: Resources and development	**Hrs. theory 7**
Objectives:	**Content:**
Analyse the difficulties of Nepalese economic development. Explain the various aspects of Nepal's economic system.	Issues affecting the economic development of Nepal: poverty, inequality, population growth, unemployment, regional disparities and 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.**
Unit: 4 Nepalese Economy	
Sub-unit: Natural resources	**Hrs. theory 7**
Objectives:	**Content:**
Discuss the appropriate use of resources in the economic success of Nepal.	Sources of national development: Human resources Forests Land Water Minerals
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion.**
Minimum Standards: theory – 40%,	
Unit: 5 Politics and Government	**Hrs. theory 13**
Sub-unit: Democratic constitution	**Hrs. theory 7**
Objectives:	**Content:**
Distinguish between a democratic and non-democratic form of government. Examine and explain the salient features of the constitution of the Kingdom of Nepal 1990 (2047 B.S.)	Meaning and definition of democracy; characteristics of democratic government; meaning of non-democratic government. Features of the constitution of 1990: Legislative (upper house and lower house) composition, power and functions. Executive (His Majesty and Council of Ministers) composition, power and functions. Judiciary (courts – Supreme Court, appeals courts, district courts) composition, power and functions of judiciary. Fundamental rights and duties of people. Other features – election commission, emergency provisions, and constitutional amendments.

Evaluation methods: written exam	**Teaching / Learning activities and resources: classroom instruction and discussion, textbook self-study.**
Unit: 5 Politics and Government	
Sub-unit: Democratization and decentralization	**Hrs. theory 6**
Objectives:	**Content:**
Describe the role of political parties for democratization in Nepal; assess their effectiveness. Explain decentralization and local level governments of Nepal. Explain how each Nepali citizen can perform their civic duties to help with successful implementation of the constitution of Nepal. Discuss how the heatlth worker can promote civic responsibility and community participation in the democratic process.	Political parties and democratic exercise in Nepal. Meaning and importance of decentralization; local level government – Village Development Committee (VDC) Municipality District Development Committee (DDC)
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion.**
Unit: 6 Foreign Policy	**Hrs. theory 12**
Objectives	**Contents**
Identify the determinants of Nepal's foreign policy. Explain the characteristics of Nepal's foreign policy. Explain Nepal's foreign policy with special reference to her relations with India and China. Identify Nepal's role in the peacekeeping	Determinants of Nepal's foreign policy: Geographical • Historical • Cultural • Economic • International. Features of Nepal's foreign policy: • Non-aligned

movement of UNO. Assess the importance of regional cooperation with organizations such as SAARC.	• Panchasila • Acceptance of UNO charter • Regional cooperation • Peace movement • Disarmament • Others Nepal's relations with its neighbors: • China • India Nepal's relationship with UNO Foundation of SAARC; Nepal's role for the development of the SAARC countries.
Evaluation methods: written exams	**Teaching / Learning activities and resources: classroom instruction and discussion.**

Physics for Forestry

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.

Minimum Standards:

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

Recommended text:

Brij Lai and Subramanyan, Principles of physics.

Nelkon and parker, advanced level physics (5th ed.)
Shrestha, V.P, Physics Practical Gude

Reference Texts:

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

Course: Physics for Forestry	**Hrs. Theory 117**	**Hrs. lab 78**
Unit 1: Mechanics	**Hrs. theory 21**	**Hrs lab 6**
1.1 units and measurement	**Hrs. theory 3**	**Hrs. lab 8**
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 Convert one system of units into another system of units Express derived units in terms of funda mental units. Use of dimension to derive simple physical quantities and equations	The use of meter scale, spring, balance, and physical balance, stopwatch for measurement of length, mass and time Basic table of measurement for units of mass, length and time Demonstration of vernier calliper, screw gauge, speedometer, physical balance, spring balance and measuring cylinder.. Explain the physical concept 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	
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.	Scalar and vectors with examples Vectors addition by parallelogram and triangle method	

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	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 5**
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. State and prove principle of conservation of linear momentum with examples.	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 $v=\omega r$ vector nature of velocity and change of the direction of velocity in circular motion. the magnitude of centripetal force and

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	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 3**
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 State the condition of equilibrium of a body Differentiate between center of gravity and center of mass.	Laws of gravitation $F=GMm/ R2$ Acceleration due to gravity, mass and weight. Derive $g = GM/R^2$ .the relation between gravitation constant and acceleration due to gravity. The variation of g due to height and depth. Center of mass and center of gravity. Constitutions of equilibrium of a body with

	examples. 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 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 $P=\varrho gh$. 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 18**
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: $C/5 = (F-32)/9=(K-273)/5$ Relation between different temperature scales. 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 5**
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 teal and apparent expansion of liquid. Explain the change in density of a substance with the variation of temperature. Discuss the density variation of water with 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. Use of water cooling and heating purposes.
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 6**
Objectives	**Contents**
Define heat capacity, specific heat capacity. Distinguish between joule and calories as heat unit. Explain the quantity of heat content of a body $Q=ms\theta$. Explain the energy required to cause a phase change at constant temperature. Define freezing, melting and boiling point of a substance. Explain latent heat of fusion and latent heat of vaporization. Discuss the effect of pressure on melting and	Heat capacity, specific heat capacity. The relation between joule and calorie. Melting point, boiling point and freezing point of a substance. The effect of pressure on melting and boiling point of substance. Determination of latent heat of fusion of ice by the method of mixture. Simple numerical problems.

boiling point of the substance.	
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: Thermal Conductivity	**Hrs theory 4**
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
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 17**
3.1 Reflection of light	**Hrs theory 7**
Objectives	**Content**
Explain the laws of reflection of light. Find the deviation of light by plane mirrors as rotating mirror. Distinguish between real and virtual image. Show that in plane mirror object distance = image distance. Define the terms pole, center of curvature, radius of curvature, principal focus, principal axis, focal length. 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 Principles of reflection of light The rotation of mirror through angle θ. The reflected ray is rotated through 2θ. Object distance is just equal to image distance i. e.u=v but the image is virtual Real and virtual image. Image formation of spherical mirror. How to correct sign for the focal length, object distance and image distance. 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 sxis. 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. Verify the laws of refraction of light and define refractive index of different media. Derive the expression for apparent depth and lateral shift in a glass slab. Define critical able 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.	Phenomenon of refraction. Refractive index in terms of the speed of light in vacuum to the speed of light in medium. The relations ${}_a\mu^g \times {}_g\mu^a=1$. Refractive index in terms of real depth and apparemt depth. The relation $d=t\ (1-1/\mu)$ and lateral shift $P=t[\sin(i-r)]/\cos r$. Derivation of the formula $\mu=1/\text{Sinc}$. 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 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 8**
4.1: Electrostatics field	**Hrs theory 8**
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 several point charges Define electric potential difference, potential energy and electron volt. Explain the equipotent surface Explain the zero potential. 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. Potential and potential energy Analogy between electric potential and gravitational potential. Electron volt and its use Capacitor and capacitance and its units.
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 14**
5.1: Fundamentals of Magnetism	**Hrs theory 8**
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.	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
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
5.2: Terrestrial magnetism	**Hrs theory 6**
Objectives:	**Content:**
Describe the dip, declination and horizontal	Dip, declination, horizontal and vertical

components of earth's magnetic field. Define and give the properties of dia, para and ferromagnetic materials.	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: Current electricity	**Hrs theory 18**
6.1: 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
6.2: 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. Define joule's conversion factor.	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. Meaning of *emf* and internal resistance *ofa* cell relation E=V+Ir

	Electric power, watt, kilowatt, kilowatt-hour and horsepower. Meaning of joule's conversion factor. 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
6.3: Alternating current	**Hrs theory 5**
Objectives	**Contents**
Describe alternating current (AC) and its interpretation. Relate rms and mean value of current and voltage with its peak value. Appreciate that ac meters measures rms values only. Explain the working of a transformer and its losses. Describe step up and step down transformers. State and explain faraday's laws of electromagnetic induction.	AC and DC importance of AC over DC. Expression i_{rms}, v_{rms} and i_{mean}, v_{mean} with peak value. Working of a transformer and energy loss mechanisms in transformers. Faraday's law of electromagnetic induction
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
Unit 7: Modern physics	**Hrs theory 21**
7.1: Electrons alternating current	**Hrs theory 3**
Objectives	**Contents**
Explain the practical nature of electricity. Discuss the nature, production and properties of cathode rays Review the motion of electrons in electric and magnetic fields.	Partical 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
7.2: Photoelectric	**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. Draw a photoelectric equation. Give the application of photoelectric effect	Photoelectric effect, quantum theory of radiation. Einstein's photoelectric equation $hv=\varphi+1/2mv^2$ 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
7.3 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
7.4: Radioactivity	**Hrs theory 4**
Objectives	**Contents**
Explain the difference between natural and artificial radioactivity List the main properties of α, β and γ radiation. Explain why these forms of radiation have energy on the order of mega electron voltage. Write down the equation for the laws of radioactivity	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. $N=N_o e^{-\lambda t}$, $dN/dt = -\lambda t$

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.	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
7.5: 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 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.	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. Calculation of mass, defect and loss of mass due to radioactive disintegration numerically.
7.6: Physics and society	**Hrs theory 3**
Objectives	**Contents**
Describe how our environment is being destroyed due to noise pollution, air pollution and water pollution Discuss the wide spectrum of electromagnetic radiation form radio waves to cosmic rays. Discuss ozone depletion, greenhouse effect, and acid rain. Discuss strategies to reduce pollution at local	Deteriorating conditions of the environment we live in. Useful and harmful aspects of radiation. Concepts about ozone depletion, greenhouse effect and acid rain. Environmental protection strategies.

and national levels.	
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems

Physics Practical	
Course: Physics Practicals	**Hrs lab 78**
Objectives	**Contents**
Determine the volume of a hollow cylinder and a solid cylinder using vernier calipers.	Volume of hollow and cylinder using vernier calipers
Determine the volume of a steel ball using a screw gauge	Volume of steel ball using screw gauge
Determine the area of a glass rod using a screw gauge.	Area of glass rod
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
Determine the specific gravity of solids dissolved in water.	Specific gravity of solids dissolved in water
Determine the specific gravity and density of substances lighter than water.	Specific gravity and density of substances lighter than water
Determine the specific gravity of substances lighter than water	Specific gravity of substances lighter than water
Verify laws of refracting and find the refractive index	Laws of refracting Refractive index
Find the focal length of a convex lens by the double pin method.	
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
Determine the latent heat of fusion of ice.	Latent heat of fusion of ice
Determine the magnetic moment and pole-strength of a bar magnet by locating the neutral points, keeping N-pole pointing south	Magnetic moment and pole-strength of a bar magnet by locating the neutral points

and N-pole pointing north.	
Verity Ohm's law by using an ammeter and voltmeter.	Ohm's law
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
Determine the refractive index of a prism using the 1-D curve method.	Refractive index of prism
Verify Archimedes' principle and find the specific gravity and density of solids insoluble in water. Determine the resistance of given writes by meter-bridge.	Application of theory from preceding units.
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 for Forestry

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

Minimum Standards

Students must achieve a minimum of 60% accuracy in practical, 40% accuracy in theory.

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, Ist Indian edition-1987.
10. Soil Science.
11. N.K Vishnoi Advanced Practical Organic Chemistry.- Second revised edition Vikas Publishing Pvt-Ltd.

Course: Chemistry	**Hrs. theory 117 Hrs. lab 78**
Unit 1: Physical Chemistry	**Hrs. theory 51**
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 12. Identify physical and chemical change. 13. 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. 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?	1. Modern periodic classification of elements. 2. Location of s, p, d, f-block elements 3. Periodicity in properties by: 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, Isomorphism, liquid crystal and substances.	1. The deference between amorphous and crystalline solids 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	1. Valence electron, duplet, octet and Noble gas electronic configuration 2. The mode of formation and properties of compounds

different molecules. 3. List the properties of electrovalent, covalent and co-ordinate covalent bond. Q. Why is ammonia readily soluble in water?	(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.	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

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°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	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	**Teaching/Learning activities and resources:** classroom instruction,

observation in lab	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	1. Equivalent and gram equivalent

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.	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 38**
2.1: An introduction to organic Chemistry	**Hrs. theory 4**
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	**Teaching/Learning activities and resources:** classroom instruction,

observation in lab	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**
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. 3. Describe the test of alkyne	1. Laboratory preparation of ethyne from calcium carbide 2. Physical properties of acetylene 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. 2. Describe the physical and chemical characterstics of ketonic compound. 1. List the uses of ketonic compounds.	3. Preparation from isopropyl alcohol and Ca-acetate 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.	1. Preparation from acetylene and ethanol

2. Describe the physical properties of acids (solubilty, acidic character). 3. Describe the uses of vinegar. Q. Write down the uses of acetic acid.	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 9**
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 6**
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
3.3 : Food Chemistry.	**Hrs. theory 1**
Objectives.	Contents.
3. To make lists of hygienic foodstuffs.	Advances in Food Chemistry.
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. Benzene	Hrs. Theory 1
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: Environmental Chemistry	**Hrs. theory 4**
4.1: Pollution	**Hrs. theory 4**
Objectives	Contents
Define Environment Define the Environment related terminology Pollutant, Receptor, Sink, Speciation, Threshold Limit value (TLV) Describe why environment is getting polluted Define acid rain and Identify the causes of Acid rain Describe the treatment of domestic waste List the negative effects of radiation, ozone layer depletion and green house effect	The sources and adverse effects due to the following air pollutants- CO_2, SO_2, H_2S, Co, Hydrocarbon, Lead, cadmium dust, EFC, Oxides of nitrogen Indoor air pollution Effects of air pollution on -human health, materials and climate Pollutants of acid rain Adverse effects of acid rain Mode of water pollution Water pollutants- inorganic pollutants organic pollutants, domestic waste, , industrial and agricultural waste, fluorides Effect due to water pollution Effect due to radioactivity Green house effect
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 3. Explain the method of purification of drinking water	Soft and hard water The process of removal of hardness: -Boiling, Clark's process using washing soda, permutit process, soda-ash method, deionization of water The advantages and disadvantages of hard water

4. Define degree of hardness of water 5. Define heavy 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	i) Oxygen Cycle

house effect.	ii) Nitrogen Cycle iv) Carbon Cycle and v) Water cycle

Chemistry Practical

General Chemistry-Practical	**Hrs Lab 8**
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 3. Demonstrate the methods for chemistry lab documentation	1. Procedural rules and guidelines of the chemistry lab 2. Proper handling of equipment 3. Lab safety measures 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 3**
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 10**
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 with a bench of sodium hydroxide. b. Sodium carbonate with hydrochloric acid 5. Prepare a soluble derivative of barium carbonate and sodium chloride	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

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.
2. Inorganic Chemistry-Practical	**Hrs Lab 16**
Practical 1. Preparation of gases	Hrs. theory Hrs lab 8
Objective	Contents
1. Prepare hydrogen, ammonia and carbon dioxide gases. 2. Identify the properties of hydrogen, ammonia and carbon dioxide gases.	1. Use of apparatus required for gas experimentation 2. Chemicals used in gas experimentation. 3. Physical and chemical properties of selected gases
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. Salt analysis	Hrs. theory Hrs. lab 8
Objectives	Contents
1. Perform salt tests for acid radicals by dry and wet methods.	1. Procedures for identification of acid radicals in salt.
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.
3. Physical Chemistry-Practical	**Hrs Lab 12**
Practical 1: Equivalent weights	Hrs. theory Hrs. lab 6
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 6**
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
4. Organic Chemistry-Practical	**Hrs lab 12**
Practical 1. Element detection	Hrs. theory Hrs lab 6

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 6
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.

Food Chemistry Practicals

Course: Chemistry Practicals	**Hrs .lab 30**
Practical 1: <u>Identification of forest products containing carbohyderate, protein and lipids</u>	**Hrs.10 lab**
Objectives	*Contents*
Prepare the list of forest products containing carbohydrate, protein and lipids	• Making a list and identification of the forest product containing carbohyderate, protein and lipids.

Evaluation methods: practical performance, test, viva	Teaching learning activities and resources: classroom instruction, demonstration.
Practical 2: Techniques of phytochemical screening	**Hrs.10 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 3: Listing medicinal plants and their uses	**Hrs.5 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 4: P4 value of the soil	**Hrs.5 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.

Zoology for Forestry

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, animal diversity, ,evolution of organisms and the relationships between organisms and environment , the study of different types of tissues and a detailed study of the anatomy and physiology of mammals.

Practical zoology includes the study of microscope, study of museum specimens, preparation of temporary slides, dissection of earthworm, frog and squirrel so as to expose different systems.

- 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.

Minimum standards

Students must achieve a minimum of 40% accuracy in theory, 60% accuracy in lab.

Recommended Text Books:

A text Book of Biologicy Part II - Aggrawal, S.
Modern Text Book of Zoology, Invertebrates - Kotpal, R. L.
Modern Text Book of Zoology, Vertebrates - Kotpal R. L.
A Textbook of Higher Secondary Biology, Vol I & Vol II - Arvind K. Keshari, Ghimire, Mishra & Adhikari
Practical Zoology (Invertebrate) - P. S. Verma
Practical Zoology (Chordate) - P. S. Verma

Reference Books:

A Textbook of Zoology - Vidyarthi R. D. and Pandey P. N.

Modern Approach to Zoology - T. C. Majupuria

Ecology and Ethology - V. K. Agrawal and V. Gupta

Course: Zoology	**Theo.117HRS Practical -78 Hrs**
Unit: 1 introduction to zoology	**Hrs. 4 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.	Meaning of zoology, Scope of zoology, different branches of zoology: Morphology, anatomy, physiology, cytology, embryology, physiology, parasitology entomology, Helminthological, proto-zoology, Bacterology, virology, paleontology, ecology, genetics, toxicology
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion textbook, 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 is a basic unit of life, Differentiate between plant cell and animal cell . Differentiate between prokaryotic and eukaryotic cell.	Ultra 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 Difference between cytoplasm and nucleoplasm
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.	Definition of cell cycle.

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.	Amitosis, mitosis and meiosis cell divisions. Differences between mitosis and meiosis cell divisions.
Evaluation methods: oral and written tests, home assignments.	**Teaching learning activities and resources:** classroom instruction, 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). Describe structure, function and location of these tissues in human body.	Definition of tissue and its types. Functions of epithelial tissues i.e protection, secretion, excretion, absorption and exchange of different materials
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. Distinguish between artificial and natural classification Identify features studied in natural electrification. List modern criteria for classification of animals Define the terms used in classification.	Definition of taxonomy, species as a basic unit of classification, systematics, taxon, lower and higher taxa Different systems of classification 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 nomenclatures. 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.	Binomial system of nomenclature adopted by Carolus Linnaeus (1707-1778). Selected examples of binomial nomenclature of animals. Five kingdom system of classification. 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, Coelentereta, Platyhelminthes, Aschelminthes, Annelida ,Arthropoda, Mollusca ,Echinodermata and Chordata). Give the classes of every phylum and two examples of each.	General charecters of phylum Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Chordara.
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 historical background of organic evolution. Give examples of organic evolution. Describe the evidences of organic evolution:morphological and anatomical palaeontolgical , biochemical,genetic and embryological. Describe the Lamark's theory of evolution giving examples cited by him. Describe the Darwin's theory of evolution with examples. Identify drawbacks of Darwin's theory of evolution. Identify drawbacks of Darwin's theory. Describe the origin and evolution of man Describe modern synthesis theory of evolution.	Evolutionary history of organisms. Evidences of organic evolution. Different theories of organic evolution.
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. Define the reproduction and describe the reproductive systems of earthworm. Describe the male reproductive organs and female reproductive organs of earthworm. Describe the nervous system of earthworm. Give the economic value of earthworm.	Systematic position habit, habitat, external, features, digestive system, reproductive system, and nervous system -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. 8 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.	Systemic position, habit and habitat, structure, and economic importance of Honeybee and 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. 10 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.	Systemic position and morphology of man. Digestive system. Respiratory system. Circulatory system. Reproductive system and Excretory system
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:	Structural and functional organization of ecosystems. Examples of ecosystems and their types. Abiotic and biotic factors of ecosystem and their interrelationships. Food chain, trophic level and energy flow in an

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.	ecosystem.
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbook, and reference book self study.
9.2 Bio-geochemical cycles	**Hrs. 6 theory**
Objectives	*Contents*
Define Biogeochemical cycle. Describe the Carbon cycle, Water cycle Oxygen cycle and Nitrogen cycle.	Sources of carbon, oxygen, water and nitrogen. Cycle. The movement of these elements in different forms in between abiotic and biotic components of environment.
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbooks, and reference books self study.
9.3 ecological imbalances and consequences	**Hrs. 4 theory**
Objectives	*Contents*
Explain the theory of the greenhouse effect. List the cause of green house effect. Write the consequences of the green house effect. Discuss the significance of green house effect, and explain why many scientists believe it will create a global crisis. Define the acid rain 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.	Description of greenhouse effect, acid rain and depletion of the ozone layer.

Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbooks, and reference books self study.
Sub unit: 9.4 Environmental pollution	**Hrs. 4 theory**
Objectives	*Contents*
Define pollution. List biodegradable pollutants. List nonbiodegradable pollutants. List the sources of water pollutants. Identify the causes of water pollution. List the effects of water pollution List the preventive measures to control the water pollution. List the source of air pollution. List the effects of air pollution Mention the preventive measures to control air pollution.	Definition of air pollution and pollution. Types of pollution. Source of water pollution, their effect and preventive measures. Source of air pollution, their effect on living organisms and preventive measures of air 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.4 theory**
Objectives	*Content*
Define adaptation. Define the aquatic adaptation with examples. Define the terrestrial adaptation. List the different types of terrestrial adaptations along with examples.	Meaning of adaptations Explanation of the adaptational features and examples of aquatic adaptation Explanation of the adaptational features of terrestrial adaptation and its types along 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 taxes and their types. Explain leadership and qualities of a leader.	Definition of learned behavior and inborn behavior Definition of reflex action

List some common examples of leadership in animals.	Definition of taxis and its types Definition of Leadership and the qualities of leader
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. 6 theory**
Objectives	*Contents*
Define wildlife. Define the endangered species. List the endangered species of Nepal and causes of extinction. Define the rare and threatened animals with examples. List the methods to conserve the wild life. Give the methods to conserve the forest. Explain the importance of afforestation. List the national parks and wildlife reserves of Nepal.	Definition of wildlife Importance of wildlife conservation Categories of wildlife. Endangered species in Nepal and causes of extinction National parks, wild life reserves of Nepal Conservation strategy. Forest conservation, important of afforestation 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 .lab 78
Unit 1: Use of the microscope	**Hrs.4 lab**
Objectives	*Contents*
Name different types of microscope and their parts. Handle a microscope properly. Draw a labeled well labella diagram of microscope	Microscope, types, functions of its different parts, observation techniques.
Evaluation methods: practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, demonstration.
Course: Practical Zoology **Unit 2:General study of the animal kingdom**	**Hrs.14 lab**
Objectives	*Contents*

Study the given slides, specimens Draw diagrametic given specimens Write down the characters of given specimens slides classify the specimens properly.	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, demonstration.
Course: Practical Zoology **Unit 3: Study 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, demonstration
Course: Practical Zoology **Unit 4: Study of histological slides of mammal.**	**Hrs.8 lab**
Objectives	*Contents*
Study of the structure of the histology of different parts of the body	V.S of skin, T.S of oesophagus T.S of duodenum, T.S of liver. T-S of pancreas, T.S of spleen, T.S lung, T.S of kidney T.S of testis

	T.S of ovary
Evaluation methods: practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, demonstration.
Course: Practical Zoology **Unit 6: 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.	Striated muscle (thigh of frog) Setae of earthworm
Evaluation methods : practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, demonstration.
Course: Practical zoology **Unit 6: Dissection of animal**	**Hrs.8 lab**
6.1 Dissection of earthworm	
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
Evaluation methods : practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, demonstration
Course: Zoology **Unit 6: Dissection of animal**	**Hrs. 10 lab**
6.2 Dissection of frog	
Objectives	*Content*
Dissect the frog to expose the general anatomy, alimentary canal, reproductive system, and circulatory system, draw the well-labeled diagrams of the given systems and comment on their.	Instruments used for dissection. Exposure of general anatomy, alimentary canal, arterial system, venous system, male reproductive system and female reproductive system.
Evaluation methods: practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, demonstration.
Course: Practical Zoology **Unit: 6 Dissection of animal**	
6.3 dissection of squirrel	**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.
Course : Practical Zoology **Unit 7: Study of an ecosystem**	**Hrs. 4 lab**
7.1 Pond ecosystem	
Objectives	*Contents*
Define ecosystem Name/List/Give/etc, the abiotic and biotic factors of an ecosystem Define of aquarium -Draw the well labeled diagram to show the food chain in ecosystem.	Abiotic factors of a pond. Biotic factors of pond. Aquarium as a pond ecosystem.
Evaluation methods: practical performance, test, viva class activities.	**Teaching learning activities and resources:** classroom instruction, demonstration.
Course: Practical Zoology **Unit: 7 Study of an Ecosystem**	**Hrs. 8 lab**
7.2 Grassland ecosystem	
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 factors of a grassland Food chain of grassland ecosystem
Evaluation methods: practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, demonstration.

Botany for Forestry

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.

Minimum Standards:

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

Recommended Textbooks:

Dutta, A. C. *A Class book of Botany.* Oxford University Press, Calcutta.
Bhattia K. N. and Khanna. *Modern Approach to Botany.* Surya Publications, Jalandhar, India.
Pandey, S. N. and P. S. Trivedi. *A Textbook of Botany* (Vol 1). Vikas Publishink House Pvt Ltd, New Delhi, India.
Pandey, S. N. and P. S. Trivedi. *A Textbook of Botany* (Vol 2). Vikas Publishink House Pvt Ltd, New Delhi, India.
Pandey, B. P. *Taxonomy of Angiosperms.* Chand and Company Ltd, New Delhi, India.
Sinha, V. and S. Sinah. *Cytogenetics Plant Breeding and Evolution.* Vikas Publications Ltd , New Deldi.
Keshari, A. K. Ghimire, K. R., Mishra, B. S., and K. K. Adhikari, *A text Book of Higher Secondary Biology (Class II)* Vidyarthi Pustak Bhandar, Kathmandu.
Keshari, A. K. and K. K. Adhikari. *A text Book of Higher Secondary Biology (Class II).* Vidyarthi Pustak Bhandar, Kathmandu.
Ranjitkar, H. D. 2005. A Hand Book of Practical Botany. Mr. Arun K. Ranjitkar, Kalanki, Kathmandu.

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.

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. **Types of questions:** Very short (1 mark) and Short (3 marks)	**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. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**Teaching Methods:** Classroom instruction, textbooks, reference books, charts, diagrams, photographs, show items containing relevant biomolecules.

2.2 Water	**Theory: 1 hrs**
Objectives	Contents
Give structure and properties of water. List the functions of water in living systems.	Structure, properties and functions of water.
Evaluation: Oral and written tests, home assignment. **Types of questions:** Very short (1 mark) and Short (3 marks).	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams, photographs.

2.3 Carbohydrates	**Theory: 1 hrs**
Objectives	Contents
Define carbohydrates. Define glycosidic bond. 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. **Types of questions:** Very short (1 mark) and Short (3 marks).	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams, photographs.

2.4 Proteins	**Theory: 2 hrs**
Objectives	Contents
Define proteins as polypeptides. Define essential and non-essential amino acids with examples. Define peptide bonds. Define primary, secondary and tertiary structure of protein. Define denaturation of or proteins. List functions of proteins.	Definition, types, examples, and functions of amino acids and proteins.
Evaluation: Oral and written tests, home assignment. **Types of questions:** Very short (1 mark) and Short (3 marks).	**Teaching Methods or Materials :** Classroom instruction, textbooks, reference books, charts, diagrams, photographs.

2.5 Lipids	**Theory: 1 hrs**
Objectives Define lipids as triglycerides. Define saturated and unsaturated fatty acids. Differentiate fats and oils. Define phospholipids. List functions of Lipids.	Contents Definition, types, examples, and functions of Lipids.
Evaluation: Oral and written tests, home assignment. **Types of questions:** Very short (1 mark) and Short (3 marks).	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams, photographs.

2.6 Nucleic acids	**Theory: 3 hrs**
Objectives	Contents
Define nucleic acids as polynucleotides. List components of Nucleotides. Define phosphodiester bond. Define and differentiate DNA and RNA. Define denaturation and renaturation of DNA. 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. **Types of questions:** Very short (1 mark) and Short (3 marks).	**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. Define somatic and genetic variation, continuous and discontinuous variations. Describe the significance of variation. Define the terms: Chromosome, gene,	Definition of heredity and variation Explanation of causes, types, and significance of variation Definition of terms: chromosome, gene, alleles, genotype, phenotype, and homozygous, heterozygous, clone

alleles, genotype and phenotype, homozygous and heterozygous and clone.	
Evaluation: Oral and written tests, home assignment. **Types of questions:** Very short (1 mark) and Short (3 marks).	**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. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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.	Definition, branches and applications of

List the branches of Biotechnology. List the application of Biotechnology.	Biotechnology.
Evaluation: Oral and written tests, home assignment. **Types of questions:** Very short (1 mark) and Short (3 marks).	**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. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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: 6hrs**
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	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 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.	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. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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	Internal structures of dicot and monocot stems. Internal structure of dicot and monocot

monocot stems.	stems.
Evaluation: Oral and written tests, home assignment. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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. **Types of questions:** Very short (1 mark) and Short (3 marks)	**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	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

and Pinocytosis.	
Evaluation: Oral and written tests, home assignment. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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. Identify the sites of photosynthesis. List the major steps of photosynthesis. List the factors affecting photosynthesis.	Definition of Photosynthesis. Major photosynthetic pigments and their roles 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. **Types of questions:** Very short (1 mark) and Short (3 marks).	**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. **Types of questions:** Very short (1 mark) and Short (3 marks).	**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. **Types of questions:** Very short (1 mark) and Short (3 marks).	**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. **Types of questions:** Very short (1 mark) and Short (3 marks).	**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. **Types of questions:** Very short (1 mark) and Short (3 marks).	**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

Types of questions: Very short (1 mark), Short (3 marks) and Long (7 marks).	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. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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. Describe life cycle of Yeast with labeled diagram. Describe the life cycle of *Puccinia* with labeled diagram. Describe economic importance of Fungi.	Definition, general characteristics and classification of fungi. Life cycle of Yeast. Life cycle of *Puccinia.* Economic importance of fungi.
Evaluation: Oral and written tests, home assignment. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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.	Definition and general characteristics of Pteridophyta

Describe life cycle of fern with well-labeled diagram. Give economic importance of Pteridophytes.	Description of life cycle of fern Economic importance of Pteridophytes
Evaluation: Oral and written tests, home assignment. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**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. 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.	Definition and general characteristics 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. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams. fresh plants or preserved specimens

7.11: Introduction to Angiosperms	**Theory: 1 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. **Types of questions:** Very short (1 mark)	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams

and Short (3 marks).	

7 .12: Morphology of Angiosperms	**Theory: 6 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. **Types of questions:** Very short (1 mark) and Short (3 marks).	**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:	**Teaching Methods or Materials:**

Oral and written tests, home assignment. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7 marks).	Classroom instruction, textbooks, reference books, charts and diagrams. fresh plants or preserved specimens

Unit 8: Embryology of Angiosperms	**Theory: 7 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. **Types of questions:** Very short (1 mark) and Short (3 marks).	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams.

8.2: Fertilization	**Theory: 4 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. **Types of questions:** Very short (1 mark), Short (3 marks) and Long (7).	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams.

Unit 9: Economic Botany	**Theory: 5 hrs**

9.1: Food Plants	**Theory: 2 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. **Types of questions:** Very short (1 mark) and Short (3 marks).	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams and herbarium specimens of medicinal plants.

9.2: Concept to Ethnobotany	**Theory: 3 hrs**
Objectives	Contents
Define the term 'ethnobotany'. Discuss the scope and value of ethnobotany. Discuss the value and importance of traditional knowledge.	Definition of ethnobotany. Scope and importance of ethnobotany Value and importance of traditional knowledge
Evaluation: Oral and written tests, home assignment. **Types of questions:** Very short (1 mark) and Short (3 marks).	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams.

Botany Practical

Course: Botany Practical	**Hours: 78**
Practical 1: Molecular Biology	**Practical: 8 hrs**
Objectives Test presence of reducing sugars in the given sample using Benedict's solution. Test presence of starch in given sample using Iodine solution. Test presence of protein in given sample using Biuret method. Test presence of lipid in given sample using emulsion method.	**Contents** Benedict test of Reducing Sugar. Iodine test of Starch. Biuret test of Proteins. Emulsion test of lipids.
Evaluation:	**Teaching Methods or Materials:**

viva voce, home assignment.	Lab instruction, practical activity, text books.

Practical 2: Plant Breeding	**Practical: 8hrs**
Objectives: Learn basic techniques and processes of hybridization experiments.	**Contents:** Visits to nearby agricultural centers to observe hybridization experiments.
Evaluation: Viva voce, and evaluation of mini-report, home assignment.	**Teaching Methods or Materials:** Field trip and briefing, reference books. Instruction on writing mini-report.

Practical 3: Biotechnology	**Practical: 8 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 4: Plant Anatomy	**Practical: 8 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 5: Physiology	**Practical: 15hrs**
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 6: Taxonomy and Biodiversity	**Practical: 28hrs**
Objectives	**Contents**
Monera:	
Study the different types of bacteria based on their morphology using permanent slides.	Classification of bacteria on the basis of shape
Study the filaments of *Nostoc* using compound microscope.	Study of *Nostoc* under compound microscope
Fungi:	
Study yeast cells and their budding under compound microscope.	Study of yeast cells and their budding under compound microscope
Study different stages in the life cycle of *Puccinia* using permanent slides	Study of different stages of life cycle of *Puccinia* using permanent slides
Plantae:	
Study structure and conjugation in *Spirogyra* using compound microscope.	Study of 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 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.

Practical 7: Embryology of Angiosperms	**Practical: 3 hrs**
Objectives Study the permanent slide of angiosperm ovule. Study permanent slide of a dicot embryo.	**Contents** Study of angiosperm ovule using permanent slide Study of dicot embryo using permanent slide
Evaluation: Viva voce, home assignment, evaluation of lab activity.	**Teaching Methods or Materials:** Compound microscope, permanent slides, charts, textbooks, lab instructions, permanent slides.

Mathematics and Statistics

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

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 differential equations.
- 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 .

Minimum Standards:

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

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 89**
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. 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)	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, 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.	Functions and their inverse and related problems Composite functions and related

Sketch a graph of the various functions. Sketch a graph of trigonometric functions.	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 Prove the bionmial theorem	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 Proof of bionomail theorem 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. 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 matrix, notation order, types of matrices and simple algebra of matrices Adjoint, inerse of a matrix and related problems 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.	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

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 ($ax^2+2hxy+by^2=0$)	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	Definition of integral as antiderivative, Application of techniques of integration as anti derivate, substitution method, trigonometric

algebric curve, X-axis and ordinate at x=a to x=b.	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 9**
Objectives	Contents

Find the general values of trigonometric equations. Use practical applications of trigonometry Solve the problems related to inverse circular functions.	Trigonometrical equations and general values Height and distance examples no.1 to 20 from textbook of intermediate trigonometry Inverse circular functions
Part B (Elementary Statistics)	
Unit 2: Elementary Statistics	**Hrs theory 28**
2.1: Introduction to statistics (Revision only)	**Hrs theory 3**
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 3**
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 5**
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 8**
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	Concept of correlation. Method of studying correlation by drawing Scatter diagram

Explain Karl Pearson's coefficient of correlation between two variables.	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 bardiagrams, 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.

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

Minimum Standards

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

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
- Civil Engineering – T. D. Ahuja and G. S. Birdi
- Building Construction – Sharma and Kaul
- Forest Engineering without tears – N. J. Masani
- Building Construction – Sushil Kumar
- Estimating and Costing – B. N. Dutta
- Manual of Building construction – Kul Ratna Tuladhar
- Manual of highway design and construction – K. R. Tuladhar
- Manual of bridges and culverts – K. R. Tuladhar
- Highway Engineering – S. K. Khanna and C. E. G. Gusto

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 2**
Objectives	**Contents**
Define forest surveying and engineering classified survey techniques. Describe the scope of surveying in forestry	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
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 Principles of surveying	**Hrs. theory 2**
Objectives	**Contents**
Describe about the principles of surveying	Principles of Surveying
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
1.4 Work of Surveyor	**Hrs. theory 2**
Objectives	**Contents**
Explain the field procedures of survey works Do the computation of survey data Get skills in care and adjustment of instruments	Field work Office work Care and adjustment of instruments
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
Unit 1. 5 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	Types of maps Mapping skills Uses of different maps
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
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 Cosine correction formula Hypotenusal allowance method Difference in elevation method
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	Direct ranging

Describe methods of 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
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources: c**lassroom 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 Obstacles in Chaining and Ranging
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
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 12***
3.1 Chain triangulation	**Hrs. theory 4**
Objectives	**Contents**
Explain the chain triangulation technique, its mathematical derivation and application	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
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
3.2 Execution of chain survey	**Hrs. theory 4**
Objectives	**Contents**
Get practical skills on cruising of chain survey and derivation of output	Field work: Preliminary survey Marking the station Chaining and offsetting Field note keeping Office work Preparing maps fundamental requirements for drawing a map: scale, direction, legends, symbols, title etc.
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
3.3 Methods of area calculation	**Hrs. theory 4**
Objectives	*Contents*
Get knowledge on how to get area from measure area from the map	Dividing the area into triangles Geographical method (counting the squares) Mechanical method (Planimeter)
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 10***
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 and numerical base of angles, bearings and local attraction	Theory of magnetic compass Theory of prismatic compass 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
Unit 5 Traversing	***Hrs. theory 10***
5.1 Basics of traversing	**Hrs. theory 5**
Objectives	**Contents**
Define traversing technique in surveying Describe about the types of traversing	Definition of traversing Types of traverse: Open and closed traverse
Evaluation methods: Oral and written test, home assignment	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
5.2 Traversing by chain and compass	**Hrs. theory 5**
Objectives	**Contents**
Get practical and fundamental skills knowledge on how to conduct traversing by chain and compass	Field work: field notes and note keeping Office work: Traverse computation and plotting by Parallel meridian method Coordinate method in detail
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 10***
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 collimination, 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 4**
Objectives	**Contents**

Gain skills in various methods of leveling	Barometric leveling Trigonometric leveling Spirit leveling
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 3**
Objectives	**Contents**
Describe about the application of spirit level Getting know handle the level instrument'	Simple application Height of instrument 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 12***
7.1 Basics of plane table surveying	**Hrs. theory 2**
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
7.2 Working operation in plane table surveying	**Hrs. theory 4**
Objectives	**Contents**
Get practical skills in the operational procedure of plane table surveying	Fixing Setting: leveling, centering, orientation, sighting
Evaluation methods: Oral and written	**Teaching/Learning activities and**

test, home assignments	**resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
7.3 Methods of plane tabling	**Hrs. theory 6**
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 6***
Objectives	**Contents**
Define contouring technique Describe the characteristics of contour lines	Basic definition of contour, contour interval, index line 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 13***
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 Forest roads in Nepal
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 6**
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	***Hrs. theory 12***
11.1 Definition	**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. 2 Construction	**Hrs. theory 4**
Objectives	***Contents***
Explain about the site selection criteria and elements for orientation of building Describe briefly about different components of building	Orientation of building and site selection Masonry Doors and windows Dampness and its effect and prevention Roofing White washing and distempering
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 4**
Objectives	**Contents**
Prepare the plan of building Estimate and calculate costs for building construction	Drawing of building norms Rate analysis Detailed estimate
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books

Surveying and Engineering Practicals

Course: Survey and Engineering Practical	**Lab 78**
Practical 1: Linear measurement	**Hrs. practical 4**
Objectives	***Contents***
Get skills in linear measurement	
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: Chain surveying	**Hrs. practical 10**
Objectives	***Content s***
Conduct chain surveying in the ground	
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: Traversing	**Hrs. practical 10**
Objectives	***Content s***
Do practice to use traversing techniques	
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: Leveling	**Hrs. practical 8**
Objectives	***Contents***
Use leveling techniques in ground	
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: Plane Table Surveying	**Hrs. practical 10**
Objectives	***Content s***
Use plane table survey techniques to prepare map	
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 6: Types of maps and their uses	**Hrs. practical 4**
Objectives	***Content s***
List the map types Compare different map types List the uses of different map types	
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 10**

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 10**
Objectives	***Content***
Align a small portion of the 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	**Hrs. practical 12**
Objectives	***Content***
Draw a small building Prepare the estimate of small buildings	
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.

Second Year

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.

Minimum Standards
Students must achieve a minimum of 40% in theory and 60% accuracy in practical.

Text and Reference books

1. Manual on Reforestation Techniques, R.C Ghosh
2. Manual on Afforestation in Nepal, J,K Jackson
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.
7. Forest Act of Nepal 1993, DoF, GoN.

Course: Silviculture	**Hrs. theory 117 Hrs. Practical 78**
Unit- 1 Introduction to Silviculture	**Hrs theory 5**
Objectives	Contents
• Define Silviculture • Explain the objective of Silviculture • Define common terms in Silviculture	Definition and objectives of Silviculture Common terms in Silviculture
Evaluation Methods: Oral and written tests, assignment	**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 Explain importance of Locality factors List and explain the different types of locality factors Explain different influencing agents of climatic, topographic, edaphic and biotic factors	Definition, importance and classification Climatic factors Topographical factors Edaphic factors Biotic factors
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. Concept of succession	**Hrs Theory 7**
Objectives	Contents
Define succession Explain concept of succession List different types of succession (Primary and secondary) List and explain the causes of succession Define climax Explain concept of climax	Description and evolution of concept Kinds of succession (Primary, Secondary) Causes of succession Concept of climax
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. Forest Type Classification on	**Hrs Theory 7**

Ecological Basis	
Objectives	Contents
• Explain the basis of forest classification • Define the feature of Tropical forest and list the species that occur. • Define the feature of Sub-Tropical forest and list the species occurred • Define the feature of temperate forest and list the species that occur. • Define the feature of Sub-alpine forest and list the species that occur.	Basis of forest classification Tropical Sub tropical Temperate Sub Alpine
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 5 Forest classification basis of management objectives and ownership	**Hrs Theory 7**
Objectives	Contents
• Define government managed forest and community Forest • Explain management objectives of different types of government managed forests i.e. National forest, Protection forest, Production forest, National park and reserves • Explain the management objectives of community forest, collaborative forest, private forest, leasehold forest, Religious forest	Types of government forests: National forest, Protection forest, Production forest, National parks and reserves Community forest Collaborative forest Private forest Leasehold forest Religious forest
Evaluation Methods: Oral and written test, assignment	**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 system	Introduction

• List types of silvicultural system • Define clear felling system, shelter-wood system, selection system, coppice systems • Explains application of different silvicultural system	Types of silvicultural systems Clear felling system Shelter wood system Selection system Coppice system
Evaluation Methods: Oral and written test, assignment	**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
• Define silvicultural characters • Explain silvicultural characters of selected species	Indigenous species: Sal, Sissoo, Khair, Simal, Katus, Chilaune, Utis, Champ, Pines (Chir and Blue) Exotic species: Eucalyptus, Teak, Popular Fodder: Badahar, Nimaro, Khanyu
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 Natural and Manmade forest	**Hrs Theory 10**
Objectives	Contents
• Define natural forest and manmade forest • Explain the factors affecting natural regeneration • Explain the methods of natural regeneration • Explain the importance of natural and artificial regeneration • Describe on the plantation activities in Nepal.	Natural Regeneration, Factors affecting natural regeneration, Importance of natural and artificial regeneration, Plantation activities in Nepal
Evaluation Methods: Oral and written test, assignment	**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 in Nepal • Explain seed year and time of seed collection for different species. • Explain the method of seed collection, seed extraction and storage • Define germination capacity, germination percentage and viability.	Seed production by conifers and broad-leaved tree Seed year Time of seed collection Methods of seed collection Seed extraction and storage Germination capacity, germination percentage and viability
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 Choice of species for reforestation	**Hrs theory 9**
Objectives	Contents
• Define reforestation and explain importance of reforestation • List the suitable species for different land use practice	Reforestation 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, assignment	**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. • Explain the criteria for selection of nursery sites • Describe and get skills in the techniques of nursery construction	Nursery Types of nursery (Temporary and permanent) Criteria for nursery site selection Nursery construction Seed beds preparation (Sunken and Raised)

and bed preparation • Demonstrate and explain the method of seed treatment • Explain the techniques of seedling production, protection and maintenance of seedlings	Seed treatment Seedling production (Container, bare, stumps) Protection and maintenance of seedlings
Evaluation Methods: Oral and written test, assignment	**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 planting sites (slope, aspect, exposure, vegetation, soil) • Describe techniques of ground preparation, spacing and pitting. • Describe on techniques of handling of seedlings • Differentiate plantation and direct sowing	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, assignment	**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 • Explain weeding and cleaning • Describe assessment and replacement of losses • Differentiate thinning and pruning operation • Explain intercropping practices in	Importance of tending operation in plantation forest Weeding and cleaning Assessment and replacement of losses Thinning and pruning Intercropping (Taungya)

Nepal	
Evaluation Methods: Oral and written test, assignment	**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 16**
Objectives	Contents
• Construct a forest nursery • Prepare cutting • Demonstrate the grafting and layering • Prepare nursery beds • Demonstrate the practice of soil mixing, container filling and seed sowing	Nursery materials Nursery layouts Nursery bed preparation Preparation of nursery materials
Practical 4: Seed Science	**Hrs 16**
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 the about the attraction and services in tourism.

This Course as 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, fishes 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, GEF, CITES, World Heritage Convention etc.),
- Trans-boundary Coordination.

Minimum Standards

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

Recommended Texts and Reference Books

Wildlife Biology – Ramond F. Dasman, University of California
Text Book of Wildlife Management Techniques – S. K. Singh
Introduction to Wildlife Management – James H. Shaw
Principles of Tourism – Allam Collier
The Tourism System – Robert C. Mill and Alastair C. Mill
Recreation Trends – Towards the year 2000 – John R. Kelly
Ecotourism for Forest Conservation and Community Development – RECOFTC

Course: Wildlife and protected area managemenmt	***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, 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 • Medicinal, aromatic and edible 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	**Hrs. theory 20**

wildlife (Fishes, Amphibians, Insects need to be added)	
Mammals	*Hrs. theory 6*
Objectives	Contents
Explain the ecological characteristics of Mammals	• Musk deer, antelopes • Tiger, Leopard cat, Wild dog, Brown bear • Blue sheep • Dolphin • Big mammals: Rhino, Elephant, Arna At least the species in schedule 1of NPWC Act 2029
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
2 Birds	*Hrs. theory 4*
Objectives	Contents
Explain about the brief ecological characteristics of birds	• Pheasants, storks, floricans, crane, giant hornbill
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
3 Reptiles	*Hrs. theory 4*
Objectives	Contents
Explain the ecological characteristics of reptiles	• Python, crocodiles, golden monitor lizard
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
4 Insects	Hrs theory 3
Objectives	Contents
Explain the ecological characteristics of insects	• Ant, Termite, Bee
Evaluation methods: oral and written test,	**Teaching/Learning activities and**

home assignments	**resources:** classroom instruction, illustrations, diagrams, visuals, text book, reference books
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 3Wildlife values and Legal status of wildlife	***Hrs. theory 12***
1 Wildlife values	*Hrs. theory 5*
Objectives	Contents
Elaborate the value of wildlife Describe about different values of wildlife i.e. Positive and Negative, Direct and Indirect, Consumptive and non-consumptive	• Positive values: Consumptive and non-consumptive values • Negative values: wildlife depredation, disease reservoir • Measuring wildlife values: aptitude survey
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
2 Legal status of wildlife in Nepal	*Hrs. theory 7*
Objectives	Contents
Explain the policies formulated in Nepal in wildlife management and nature conservation	• National Parks and wildlife conservation act • Buffer zone management rules and guidelines • CITES, IUCN, WWF, Ramsar convention, NTNC, 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***

1 Population dynamics	*Hrs. theory 6*
Objectives	Contents
Overview the different parameters of population dynamics	• Fatality and Mortality • Age structure, Sex ratio • Population growth
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
2 Population estimation techniques	*Hrs. theory 8*
Objectives	Content
List the methods of wildlife population estimation Explain the different methods of wildlife population	• Mark and recapture technique • Transect surveys • Pellet-group counts • Roadside counts • Antler counts (Cervids) • Call and nest counts (birds)
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***
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
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
3 Buffer-zone management	*Hrs. theory 5*
Objectives	Contents
Define buffer-zone management acquire skills practice of bufferzone 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
4 Eco-tourism management	*Hrs. theory 6*
Objectives	Contents
Define different terms used in habitat management (e.g. grassland, wetland, water hole, shrub/ scrub land, forest fire, forest road)	• Travel and tourism, eco-tourism • Dimensions of travel • Tourist services • Growth of world tourism • History and growth of tourism in Nepal • Types of forest
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

	• Building relationship between park and people
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***
1 Recreation in natural resource environment	*Hrs. theory 6*
Objectives	Contents
Define recreation management Provide details of different packages for recreation management	• Importance of eco-tourism • Motivating for environmental tourism • Backpacking and hiking, Camping • Rafting, fishing, hunting, bird-watching, jungle walk • Canoeing, Kayaking, elephant riding, horse riding • Role of eco-tourism
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
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
3 Resource management and staff accommodation	*Hrs. theory 4*
Objectives	Contents
Explain the community development in/around the tourism	• Trail construction and facility • Garbage disposal road layouts

Explain the staff management and community awareness	• 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***
1 Tourism regulation	*Hrs. theory 4*
Objectives	Contents
Describe the tourism regulations	• Introduction of tourism regulation • Controlling the travel industry • Tourism legislation and regulation
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
2 Socio-economic consideration	*Hrs. theory 6*
Objectives	Contents
Explain about the socio-economic consideration of tourism	• Role of tourism in economic development • Social impact of tourism
Evaluation methods: Oral and written test, home assignments	**Teaching/Learning activities and resources:** classroom instruction, illustrations, diagrams, visuals, textbooks, reference books
3 Ecological consideration	*Hrs. theory 4*
Objectives	Contents
Explain about the ecological consideration of tourism	• Carrying capacity assessment • Limits of acceptable change
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***
1 Attraction	*Hrs. theory 5*
Objectives	Contents

Define attraction factor in tourism and recreation management Explain the types of attraction	• Definition • Types of attraction: Socio-cultural, Natural and Manmade
2 Services	*Hrs. theory 5*
Objectives	Contents
The facilities and services to provide to visitors	• Visitor Information center • Hotels, Hospitals • Park, rest places • Facilities
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 Practicals:

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 their pellets
Practical 3: Identification of Rhino horn and fake horn, skull of tiger and leopard and other canid/feli	**Practical Hrs:** 16
Objectives	*Contents*
Identify animal parts and specimen	Identification of Rhino horn and fake horn, skull of tiger and leopard and other canid/feli
Practical 4: Sexing Jaw identification	**Practical Hrs:** 15
Objectives	*Contents*
Identify animal parts and specimen	Sexing Jaw identification
Practical 5: Population estimation in fields	**Practical Hrs:** 20

(Transect survey, road side count, Pellect-group counts, Antler count, Call and Nest count).	
Objectives	*Contents*
Conduct wild animal census	Population estimation in fields (Transect survey, road side count, Pellect-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

Integrated Watershed Management

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

COURSE DESCRIPTION

This course combines introductory soil science (Part-I) with integrated watershed management (Part-II). 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 integrated watershed and hydrology, soil erosion and its consequences, soil conservation measures, system approach to watershed management and land evaluation and land-use planning techniques.

COURSE OBJECTIVES

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

- 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.
- define integrated watershed management and describe important interactions among 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.

Minimum Standards:

Students must achieve a minimum of 40% accuracy in theory and 60% accuracy in practical**.**

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: Integrated Watershed Management (Theory hrs. 117 Practical hrs. 78)	
Part I: Introductory Soil Science	**Theory hrs: 58**
UNIT 1: Introduction	**Theory hrsS: 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: Significance of soils in Nepal	**Theory hrs: 2**
Objectives	***Contents***
• Explain the significance of soil	Significance of soils 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 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: Introduiction of Forest Soils of Nepal	**Theory hrs: 5**
Objectives	***Contents***
• List major forest soil types of Nepal. • Explain effects of forest or vegetation forest types on soil.	• Major forest soil types of Nepal • Effects of Forest vegetation or forest types on soil

• Explain the soil condition in different land uses.	• 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

Part II: Soil Conservation & Watershed Management	**Theory hrs: 59**
UNIT 1: Concept of Integrated Watershed Management	**Theory hrs: 6**
1.1: Definition & Characteristics of Integrated Watershed Management	**Theory hrs: 3**
Objectives	***Contents***
• Define the basic terms of integrated watershed management. • Explain the characteristics of integrated watershed management.	• Definitions of terms (Watershed/sub watershed, Watershed boundary, Watershed management/sub watershed management, Integrated watershed management & others) • Characteristics (Watershed, Climatic & Physiographic)
Evaluation methods: oral and written tests and home assignment	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
1.2: Integrated Watershed Management	**Theory hrs: 3**
Objectives	***Contents***
• Explain the concept of IWM. • Explain the efforts made for IWM in Nepal.	• Objectives & categories of integrated /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 2: Introduction to Hydrology	**Theory hrs: 8**
2.1: Basic concept of hydrology	**Theory hrs: 3**
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
2.2: Measurement of discharge	**Theory hrs: 5**
Objectives	***Contents***
• Explain the measurement of precipitation, infiltration and discharge by simple method. • Perform actual measurement of precipitation, infiltration and discharge by simple method.	• 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 3: Soil Erosion and its Consequenmces	**Theory hrs: 14**
3.1: Concept of Soil Erosion	**Theory hrs: 7**
Objectives	***Contents***
• Define soil erosion and explain about its types. • Explain and 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
3.2: 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
3.3: Consequences of erosion	**Theory hrs: 4**
Objectives	***Contents***
• Explain the consequences of soil erosion.	• Gully formation • Landslides • Damage caused by soil ersion 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 4: Soil Conservation Measures	**Theory hrs: 14**
Sub unit 4.1: 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
4.2: 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	• Plantation and seeding • Manure, fertilization and mulching • Control of grazing/rotational grazing • Cropping pattern

measures of soil conservation	
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
4.3: 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
4.4: Extension Programs for Importance Soil 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 5: System Appreoach to Watershed Management	**Theory hrs: 9**
Sub unit 5.1: 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
5.2: 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
5.3: Preventive Measures	**Theory hrs: 5**
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
5.4: Participatory approach to watershed management	***Theory hrs: 5***
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 6: Land Evaluation and Land Use Planning	**Theory hrs.: 8**
6.1: Land Evaluation	**Theory hrs: 3**
Objectives	***Contents***
• Explain land evaluation process and	• Land evaluation

techniques. • Perform land evaluation of the particular land.	o Effective depth o Texture o Permeability o Slope o Soil reaction, o Color o Parent material o Natural vegetation o 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
6.2: 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

Integrated Watershed Management Practical

COURSE: Integrated Watershed Management Practical	**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: Integrated 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, forest based micro-enterprise development and management, adaptive collaborative management (ACM) 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 awarnes of their roles or responsibilities:

- give an overview of community forestry programs in Nepal.
- monitor and Evaluate community forestry programs in Nepal.
- provide villagers with suitable advice and tools for making forestry programs successful.
- demonstrate awareness of the roles and responsibilities
- give an overview of ACM approach as an added value to community forestry.

Minimum Standard

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

Better separate the text books or references:

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. Villagers, Forests and Foresters. The Philosophy, Process and Practice of Community Forestry in Nepal. D. A. Gilmour and R. J. Fisher. Sahayogi Press, Kathamndu.
4. Forest User Groups in Nepal. Messerschmidt, Richard and Shrestha, IOFP

Technical Paper.
5. Elements of Community Forestry by B. P. Kayastha.
6. Field Manuals in Community Forestry. Nepal Australia Community Resource Management Project, Katmandu.
7. Forest act 2049 (1993) and Forest Rules 2051(1995)
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).

Course: Community Forestry	**Hrs. theory 117 Hrs. Practical 78**
Unit- 1 Introduction to Community forestry	**Hrs theory 8**
Objectives	*Contents*
• Define community forestry • Explain how community forestry evolved in Nepal • State the present status of CF in Nepal	Definition/Objectives/Concept of community forestry History of Community forestry in Nepal. Terminologies used in community forestry(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 6**
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 Qualities of 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 in Community Forestry	**Hrs Theory 12**
Objectives	*Contents*
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
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. CF 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, methods of investigation Users identification Inventory (socio-economic inventory, 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.
2: Negotiation	Hrs.12
Objectives	*Contents*
Define negotiation	Definition of Negotiation

Explain the major issues and methods 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 (Letter to 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.
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: 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: Livelihood Improvement Plan (LIP) and User Group Development Plan	**HRs 8**

(UGDP)	
Sub unit-5.1 Livelihood Improvement Plan	Hrs 3
Objectives	*Contents*
Define and explain the process of developing livelihood improvement plan	Definition of livelihood improvement plan (LIP) Objectives and process of 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.
5.2 User Group Development Plan	Hrs 5
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-6: Forest-Based Micro-enterprise development	**Hrs. 5**
Objectives	*Content*
Define forest-based micro-enterprise and explain the process of micro-enterprise selection and establishment	Definition of micro-enterprise Process and methods of selecting forest based micro-enterprise through CF Process of establishing micro – enterprise and operation by CFUG
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: CF Management systems in Nepal	**Hrs 5**

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: Community Based Forest Management(CBFM) Models in Nepal	**Hrs Theory 10**
Objectives	*Contents*
List different forest management regimes State the comparative advantage and disadvantages of these regimes	Description about various forest management Models (Community Forest, Collaborative forest, Buffer zone community forest, Leasehold forestry, state owned and Adaptive Collaborative Management-ACM in CF) and their salient features
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 8**
Objectives	*Contents*
• Define the term monitoring and evaluation • Discuss on objectives and methods of monitoring and evaluation • Discuss different monitoring and evaluation methods. • Explain on Initial Environment Examination (IEE). • Explain on Environmental Impact Assessment (EIA)	Objectives of M&E Methods of M&E Initial Environment Examination (IEE) Environmental Impact Assessment (EIA) Define self monitoring and evaluation systems in community forestry with indicators/checklists
Evaluation Methods: Oral and written test,	Teaching /Learning activities and resources:

assignment	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 goals and objectives of 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 8**
11.1 Governance	**Hrs 4**
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 4
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 Public auditing, Public hearing
Evaluation Methods: Oral and written test,	Teaching /Learning activities and resources:

assignment, Performance observation (Interaction and participation in the class)	Class room instruction, Observation, illustration, diagrams, visuals, text and reference books and Journals and reports.
Unit 12 Gender and Community Forestry	**Hrs Theory 10**
Objective	*Content*
Define gender, social equity, justice and rights State the issues related to Gender and Social equity in CF	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.
Unit 13 CF focused Rules and Regulation	**Hrs Theory 6**
Objective	*Content*
Name the rules and regulation related to CF Mention the legal provision regarding CF management in Master plan, Forest Act, Forest Regulation, Buffer-zone Management Regulation	Master Plan for Forestry Sector 1989 Forest Act 1993 Forest Regulation 1995 Buffer zone mgt. regulations CFDP Guideline
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 Forestry Constitution Preparation	**Hrs 18**
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 2: Community Forestry Operational Plan Preparation	**Hrs 20**
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 3: Community Forestry Monitoring and evaluation	**Hrs 32**
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-4:Conduction of Meeting and Assembly	**Hrs 8**
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. This course provides basic knowledge and skills in forest resource inventory topics including timber estimation, forest sampling, stand yield prediction and growth and yield modeling, measurement of distance and direction, 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 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 weight and volume of different forest products.
- estimate the growing stock of given forest.

Minimum Standards
Students must achieve a minimum of 40% accuracy in theory and 60% accuracy in practical**.**

Recommended Texts
Forest Inventory Guidelines, 2004
Forest Mensuration-L.S Khanna and A.N. Chaturvedi
Forest Measurement- Avery and Burkhart 1983
Forest Mensuration- Betram Husch, Charles I. Miller and Thomas W. Beers

Course: Forest Measurement	**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 25**
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.	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

State sources of errors in height and diameter measurement	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 6**
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 12**
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	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

by these formulas State the methods and formulas for fuelwood measurement	4.4 Dimensions and volume of chatta (staked fuel wood) 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 12**
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	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

advantages and disadvantages Sate the sampling design of Forest Inventory Guidelines of Nepal	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 Inventory of commercially important five NTFPs
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)

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 16 Hrs**
Objectives	*Contents*
Measure tree Diameter and Height	Use of height and diameter measuring instruments (Linear tape, caliper D-tape, Clinometer, Abney's level)
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 21**
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	Use of the following sampling methods:

Apply forest sampling techniques	-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 16**
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

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.

Minimum Standards

Students must achieve a minimum of 40% accuracy in theory and 60% accuracy in practical**.**

Recommended Texts

Forest Management – Ram Prakash
Forest Management - Davis and Johnson
Forest Economics and Valuation - M. M. Pant
Forest Resource Management - William A. Leuschner

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	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

age.	
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 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	3.1 Definition of normal forest 3.2 Concept of normal forest 3.3 Attributes of normality 3.4 Kinds of abnormality 3.5 Implication of normality concept in 3.5.1 Even aged forest 3.5.2 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: 4 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. Determine the Normal Growing Stock (NGS) State the significance of site quality in growing stock.	4.1 Definition of growing stock, increment and its type 4.2 Determination of actual growing stock 4.3 Normal growing stock and its determination 4.3.1 Determination of NGS based on MAI 4.3.2 Determination of NGS based on yield table 4.4 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: 5 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.	5.1 Definition and concept of rotation 5.2 Types of rotation 5.2.1 Physical and silvicultural 5.2.2 Rotation of maximum volume production and technical rotation 5.2.3 Rotation of highest income and financial rotation 5.3 Concept of rotation in regular and irregular forest 5.4 Choice of rotation 5.5 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-6: 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	6.1 Yield and its type 6.2 Principle of sustained yield management 6.3 Concept of yield regulation 6.3.1 By area 6.3.2 By volume 6.4 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-7: 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	7.1 Definition and concept of sustainable forest management 7.2 Principles of sustainable forest management 7.3 Criteria and indicators of sustainable

	forest management 7.4 Concept of forest certification 7.5 Various forest certification schemes 7.6 Scope of forest certification in Nepal 7.7 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-8: 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	8.1 Definition, objectives and scope of management plan 8.2 Characteristic of good management plan 8.3 Preparation of forest management plan 8.4 Community forest operational plan write up process 8.5 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-9: Forest valuation	**Hrs. theory 12**
Objectives	Content
Define use and non use values Different forest valuation techniques	9.1 Concept of forest valuation 9.2 Definition of use and non use values 9.3 Forest valuation techniques 9.3.1 Direct market price 9.3.2 Indirect market price 9.3.3 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-10: Valuing stumpage	**Hrs. theory 6**
Objectives	Content
Define stumpage Calculation of stumpage values	10.1 Definition of stumpage 10.2 Methods of calculating stumpage values
Unit-11: Demand and supply of forest products	**Hrs. theory 12**
Objectives	Content
Define concept of demand and supply of forest products Price determination of forest products Market analysis of forest products	11.1 Basic concept of demand 11.1.1 Definition of demand 11.1.2 Demand function 11.1.3 Law of demand 11.1.4 Determinants of demand 11.2 Basic concept of supply 11.2.1 Definition of supply 11.2.2 Supply function 11.2.3 Law of supply 11.2.4 Determinants of supply 11.3 Price determination of forest products 11.4 Market analysis of forest products 11.4.1 Market 11.4.2 Marketing 11.4.3 Market analysis
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: Forest based enterprise	**Hrs. theory 12**
Objectives	Content
Define forest certification Name the organizations involved in forest certification List the principles of forest certification	12.1 Definition of enterprise, entrepreneur and entrepreneurship 12.2 Definition of the business plan 12.3 Basic steps in the preparation of

List the indicators of sustainable forest.	business plan 12.4 Business plan preparation
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: 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 5: 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 6: Business plan preparation	**Hrs. practical 12**
Objectives	Content
To prepare business plan	Steps in preparation of business plan Components of business plan
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.

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.

Minimum Standards:

Students must achieve a minimum of 40% accuracy in theory and 60% accuracy in practical**.**

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: 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
Sub unit 1.1: Harvesting Tools and Equipment	Theory hrs: 9
Objectives:	***Content:***
List the appropriate forest harvesting tools and equipments Explain the use of those tools in different forest types and terrain condition. Explain the process of procurement of tools.	Identification of tools and their significance Bill hook, axe and saw and its type, wedges, bow saw, cant hook, debarking spade, measuring stick, power chain saw, cable puller, stem tightened, bow saws Feller bunchier, forwarder, skidder Procurement of tools
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Sub unit 1.2: Storage and Maintenance of Tools	**Theory hrs: 7**
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
Sub unit 1.3: Harvesting Techniques	Theory hrs: 13
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 • 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: 8**
Sub unit 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
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Sub unit 2.2: Log Extraction	**Theory hrs: 3**
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
Unit3: Transportation of Forest Products	**Hrs theory: 16**

Sub unit 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
Sub unit 3.2: Transportation of Forest Products	**Theory hrs: 13**
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**
Sub unit 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
Sub unit 4.2: Log Grading and Marketing	**Theory hrs: 5**
Objectives:	***Content:***
• Able to grade and market the forest products	• Introduction and scope of grading • Visual grading method of logs • Marketing value of logs and poles
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**
Sub unit 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
Sub unit 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
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Sub unit 2.3: Timber Defects	**Theory hrs: 5**
Objectives:	***Content:***

• Understand and explain natural and other than natural defects of wood.	• Natural defects, e.g., knots, shakes, cross grain, reaction wood etc. • Defects other than natural, e.g., seasoning defects, fungal defects, insect 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

UNIT 3: Uses of Wood as Energy Source in Nepal	**Theory hrs: 10**
Sub unit 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
Sub unit 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**
Sub unit 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
Sub unit 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
Sub unit 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
Sub unit 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
Sub unit 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 and its importance in Nepalese context. This introductory discussion provide context for subsequent and more detailed discussions of agroforestry species and agroforestry systems. The course will enhance capacity of students in designing agroforestry models. The course will cover both biological and social science aspects of agroforestry.

Course Objectives:

- Define and classify agroforestry systems.
- Select species suitable for different agroforestry practices.
- Identify the general problems that agroforestry intends to address.
- Design a small agroforestry project.
- Identify suitable species for horticulture and animal farming along with tree crops.

Minimum Standards:
Students must achieve a minimum of 40% accuracy in theory and 60% accuracy in practical**.**

Recommended Texts:
Nepal forestry Handbook - By Dr. Swoyambhu Man Amatya & Kanhaiya Raj shrestha
Forest economics, valuation & projects- By Dr. S. S. Negi
Lecture notes on Forest economics and Valuation:
Amatya, S.M. (1994). Agroforestry System and Practice in Nepal. National Forest Division, Department of Forests, Ministry of Forests and Soil Conservation, Kathmandu
Amatya, S.M. and Newman, S.M. (1993). Agroforestry in Nepal: Research and Practice. *Agroforestry Systems*, 21 (3):215-222
Agroforestry principles and practices – A. P. Dwivedi
Handbook of Agroforestry- S. P. Singh
Agroforestry practices in Nepal – S. M. Amatya
Nepalma Tarkari Kheti - DOA HMG/Nepal, Khumaltar
Cultivation and Utilization of Medicianal and Aromatic Plants - C. K. Atal and B. M. Kapur
Medicinal Plants of Nepal - Mall S. B. et al.

Fruits- Tropical and sub-tropical - T. K. Bose and S. K. Mitra

Course: Agroforestry	**Hrs. theory 117 Hrs. practical 78**
Unit: 1 Introduction to Agroforestry	**Hrs theory 12**
Objectives	Content
Define agroforestry Discuss the importance and scope of Agroforestry in Nepalese context. Correlate agroforestry with Forestry and agriculture	-Definition of agroforestry -Agroforestry practices in Nepal -Agroforestry promoter in Nepal: An introduction to Nepal Agroforestry Foundation (NAF) -Relationships with forestry and agriculture -Importance of Agroforestry (Economic, social, Biological and environmental)
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, Journals and publications.
Unit: 2 Agroforestry Systems and classification	**Hrs. theory 15**
Objectives	Content
Identify the basic components of Agroforestry Discuss criteria of classification List and describe the types of agroforestry suitable to Nepalese context	-Different criteria of classification -Different types of agroforestry (Mountain, hills and Terai region) -Agro-Silviculture -Horti-silviculture -Silvipasture (1) -Agri-silvo-pasture -Others (Aqua-Silviculture) etc -Components of agroforestry promoted by NAF
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,

	Journals and publications.
Unit: 3 Species selection for agroforestry	**Hrs. Theory 25**
Objectives	Content
Discuss the criteria of species selection List the recommended agroforestry species for fodder, fuel-wood and timber. Analyze the comparative benefits of the recommended species over the traditional ones.	Different criteria for species selection (Multipurpose use: fuel-wood, food-fruit-vegetables, fodder, shade, green manure, NTFPs and windbreak and shelterbelts etc.) -Recommended plants species (Exotic and endogenous) -Advantages of the recommended 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, Journals and publications.
Unit: 4 Design of Small Agroforestry project	**Hrs. theory 15**
Objectives	Content
Define project and tell what a "project" intends to achieve Define Biophysical and Socio-economic data Discuss the considerations to be taken while designing a project Discuss the possible components of an agroforestry project in the Terai and the hills Identify the problems of agroforestry and design an appropriate agroforestry project to address the problems	-Definition and objectives of a project - Different variables of Biophysical and Socio-economic data -Two considerations (Biophysical and Socioeconomic) -Case studies of completed agroforestry projects. - Problem tree and objective tree analysis
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, Journals and publications.
Evaluation Methods: Written tests, Home assignments and presentation,	Teaching/Learning activities and resources: classroom instruction, illustrations, diagrams,

participation/ interaction in class.	visuals, textbooks and reference books, Journals and publications.
Unit: 5 Fruit and Vegetable production	**Hrs. theory 50**
Sub-unit: 6.1 Fruit cultivation practice	**Hrs. Theory 25**
Objectives	Content
List the economically important fruits in Nepal by geographical regions Discuss about cultivation techniques and marketing of those listed fruit species	-Economically important fruits by region: -Temperate: Apple, strawberry and grapes -Subtropical: Sweet orange, lemon and pomegranate -Tropical: Mango, banana, litchi, pineapple, papaya and guava -Cultivation techniques of these fruit species -Nursery techniques -Propagation techniques -Different cultivars -Tending operations (weeding, training and pruning) -Cultural Operation -Disease/Insect/Pest -Harvesting -Post harvesting techniques -Marketing
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, Journals and publications.
Sub-unit: 6.2 Vegetable farming practice	**Hrs. theory 25**
Objectives	Contents
List the economically important fruits in Nepal by geographical regions Discuss about cultivation techniques and marketing of those listed vegetable	Economically important vegetables categorically: -Solanaceous (Potato, tomato and chili) -Cole crops (Cauliflower and brocoli) -Cucurbits (Cucumber and bitter gourd) -Root (Carrot and radish)

species	-Leguminous (Beans) Cultivation techniques of these vegetable species -Nursery techniques -Propagation techniques -Climate/Soil -Different cultivars -Tending operations (weeding, training and pruning) -Cultural Operation -Disease/Insect/Pest -Harvesting -Post harvesting techniques -Marketing
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, Journals and publications.
Agrofrestry Practical	**Hrs. practical 78**
Practical-1: Design agroforestry models	**Hrs. practical 12**
Objectives	Contents
Visit nearby Agroforestry project site Collect and identify agroforestry components Collect socio-economic and biophysical data Identify the problems of the project site Design agroforestry project	Preparation of data collection format Focus group discussion Use of RRA techniques Use of problem tree and objective tree methods for setting objectives
Evaluation Methods: Home assignment, individual presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Class room instruction, demonstration and observation
Practical-2: Field exposure on agroforestry systems	**Hrs. practical 12**
Objectives	Contents

Visit nearby agrofrestry field/farms run by the community /farmers Collect data on various components of an agroforestry systems Give presentation	Checklist for discussion with farmers 0n agroforestry
Evaluation Methods: home assignment, individual presentation, participation/interaction in the field	**Teaching/Learning activities and resources:** Class room instruction, demonstration and presentation
Practical-3: Cultivation techniques of NTFPs/Fruit/Vegetables	**Hrs. Practical 54**
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 Identify pest/disease/insect affecting the crops Carry out cultural operations in the field	Preparation of nursery beds, seed treatment techniques, Preparation of land for seed sowing and seedling planting Collect insect/pest and affect part by disease for identification Use of agricultural tools to carry out 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

Third year

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, principles of forest protection, damaged 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 t he 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

Minimum Standards:
Students must achieve a minimum of 40% accuracy in theory and 60% accuracy in practical.

Recommended Texts:

1. Forest protection, L.S. Khanna
2. Plantation forests in the temperate regions, P. Savill and Julinan Evans.
3. Forest Pathology, B.K. Bakshi.
4. The Ecology and Control of Forest Insects of India and Neighboring countries, C.F.C. Beeson.
5. Principles of Forest Entomology, S.A. Graham and F.B. Knight.
6. Forest Protection – Ralph C. Howley & Paul W. Shilkel, John wiley & sons c Inc N.Y. Champman & hall Ltd. London

Course: Forest Protection	**Hrs. theory 117. practical 78**
Unit: 1 Introduction and importance of Forest Protection	**Hrs. theory 7**
Objectives:	Content:
Define Forest Protection State the scope of Forest Protection	-Concept and definition of forest protection by various writers -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 28**
Sub-unit-2.1: Abiotic Factors	Hrs. theory -14
Objectives	Contents
To introduce abiotic factors causing damage to forest	Define abiotic factors Description about Soil condition, temperature, precipitation, wind and fire 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.
Sub-unit: 2.2 Biotic factors	Hrs. theory -14
Objectives	Contents
To 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,	Teaching/Learning activities and resources: classroom instruction, illustrations,

participation/interaction in class	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 41**
Sub unit-3.1 Plant disease, symptoms and effects	Hrs. -3
Objectives	Content
To know about the plant disease, symptoms and effects	Definition of plant disease Description of the symptoms and associated effects
Sub unit-3.2 Host-parasite relationship	Hrs-3
Objectives	Content
To understand about the host-parasite relationship	Definition and host and parasitic plants The host –parasite relationship (Hosts, Parasites, epyphytes)
Subunit: 3.3 Fungal disease	Hrs. theory -10
Objectives	Content
To 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. 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.
Sub-unit: 3.4 Insects	Hrs. theory -10
Objectives	Content
To understand the diseases caused by the insects	Define the disease caused by the various insects Describe about Sal borer, Sissoo bark borers, bamboo borers, pine borer and 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.
Sub-unit: 3.5 Important nursery pest and their control	Hrs. theory -5
Objectives	Contents
To define nursery pests and associated control measures	Define nursery pests Make lists of important nursery pests 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.
Sub-unit: 3.6 Wild animals	Hrs. theory -5
Objectives	Contents
To 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.
Sub-Unit 3.7 Harm full plants	Hrs. theory -5
Objectives	Contents
To define harm full plants and their control measures	Define harm full 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 Principles of forest protection	**Hrs. theory -10**
Sub-unit-4.1: Introduction and control measures	Hrs. theory -10

Objectives	Contents
To introduce about forest protection principles and control measures	Introduce forest protection principles Preventive measures Describe control Measures: Silvicultural (Resistant varieties and sanitations),Mechanical (Prunning, furrowing and burning),Chemical (Herbicide, Fungicide and Bacteriacide),Legal(Quarantine)
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
To 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)
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**
Sub unit-6.1: Encroachment and Illegal felling	Hrs. theory -5
Objectives	Contents
To 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
Sub unit -6.2 Improper cultivation practices and development works	Hrs. theory -5
Objectives	Contents
To understand about improper cultivation practices and different development works	Define improper cultivation practices in Nepal- Farming practices

and their effects in forest protection	Explain different development works performed inside and outside the forest and associated effects on forest protection
Sub unit-6.3: Deforestation and shifting cultivations	Hrs. theory -5
Objectives	Contents
To 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 -5**
Objective	Contents
To define and classify the forest fire	Define forest fire Explain the causes of forest fire Describe the types 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: Damages by Forest fire and control measures	**Hrs. theory -5**
Objective	Contents
To understand the damages caused by the forest fires and associated control measures	Explain the possible damages causing by forest fires Describe its prevention and control measures List out and explain the beneficial effects of forest fire
Evaluation Methods: Written tests, Home assignments and presentation,	Teaching/Learning activities and resources: classroom instruction, illustrations,

participation/interaction in class	diagrams, visuals, textbooks and reference books, journal and publications.
Unit-9: Role of stakeholders in Forest Protection in Nepal	**Hrs. theory -3**
Objective	Contents
To explain the roles and responsibilities of stakeholders in Nepalese Forest Protection	Define stakeholders in forest conservation 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: Fire fighting 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

Non-Timber Forest Products (NTFPs)

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

Course Description:

This course deals about the 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 f 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

Minimum Standards:
Students must achieve a minimum of 40% accuracy in theory and 60% accuracy in practical**.**

Recommended Texts:

1. The Indian Forest Utilization, FRI Publication Vol. I & II, Deharadun.
2. The economic value of Non- timber Forest Products in south Asia-JENNEH.DE BEER/IUCN/MELANIE
3. Medicinal and Aromatic Plants-Dr. SS Negi,Dr. Rajeev Kumar Shrivastav and Dr. NS Bisht
4. Manual of Forest Utilisation, S. Chowdhury (2003)
5. Manual of Important NTFPS of Nepal (1998), D.P. Parajuli, A.R. Gyawali and B.M. Shrestha
6. Sustainable Management of NTFPS, M.P. Shiva

Course: Non Timber Forest Products	**Hrs. theory 117. practical 78**
Unit: 1 Introduction of Non-Timber Forest Products(NTFPs)	**Hrs. 10**
Objectives:	Content:
To 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 Types/ categories of NTFPs • MAPs • Tans and Dyes • Katha and Cutch • Bamboo and Cane • Oil Seed • Leaves, Fibers and Flosses • Lac, Silk and apiculture • Resin and latex • Wild food and fruits, 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: 2: NTFPs and Livelihood	**Hrs. theory : 6**
Objectives	Contents
To understand the role of NTFPs in livelihood improvement	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 : NTFPS AND SUSTAINABLE FOREST MANAGEMENT	**Hrs. theory 6**
Objectives	Content
To introduce about the concept and practices of bio diversity and sustainable management	Definition of Bio diversity Definition of sustainable forest management Conservation of biodiversity through

	sustainable forest management
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 Ethnobotany	**Hrs. theory -14**
Objectives	Contents
To introduce about the ethnic values of MAPs and NTFPs	Definition of Ethno botany and its importance Define Ethnic value of MAPS and NTFPs 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	Importance of sustainable harvesting of NTFPs and MAPs Existing harvesting practices of NTFPs in Nepal Sustainable harvesting methods/techniques of NTFPs/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-6: Resource Assessment	**Hrs. theory -15**
Objectives	Contents
To clarify the concepts and process of resources assessment	NTFPs Inventory (what and Why) Sampling types and techniques Detail measurement Detail estimation and action
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
To deliver the knowledge and ideas regarding resin collection and processing	Importance of resin collection in rural income Resin collection practices Improved technology in resin collection 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 -16**
Objective	Contents
To explain collection and extraction methods and use of commercially valuable MAPs	Importance and scope Domestication potentiality Collection & extraction methods Parts used for medicine of commercially valuable plants Value and 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-9: Enterprises and Marketting of NTFPs	**Hrs. theory -12**
Objective	Contents
Define enterprise and marketing approaches of NTFPs	Enterprise development Micro and Macro Business plan Marketing channel
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 theo.-8**
Objective	Contents
To define value addition and post harvesting technology	Define value addition and post harvesting technology Importance of value addition Processing

Non Timber Forest Products (NTFPs) Practical-78 Hrs

Practical 1: Identification of at least 20 important NTFPs species	**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 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
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
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

Forestry Extension

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

Minimum Standards:

Students must achieve a minimum of 40% accuracy in theory and 60% accuracy in practical**.**

Recommended Texts

Forestry Extension Hand book- Dr. S.S. Negi
An introduction to extension Education- S. V. Supe
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.
A text book of extension education- B.B. Singh Dongol and N. N. Joshi

References:

Gerlach, Vernon S. and Donald p. ELY. 1980. Teaching and media. Englewood cliffs, N.J., prentice hall.
Jamias, J.F. (Ed). 1975. Readings in development communications.
Ortigas, carmela D. 1990. Long process and inductive method. March: Atenev de manila university press.
plopino R. Martinez V. and valvera J. 1987. An introduction to extension delivery systems. Manila: caches publishing house.
Quarrel, N.C. and E. D. Gomes, 1977. Development communications process, Up Los Banos: Department of Development communications.
Schramm, W. Process and Effects of Communication.
Wayne, P. et al.1970. Techniques for effective communication reading, Mass: Addison-Wesley.

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	Definitions/Scope/Objectives Ladder of earning 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 about the methods of Motivation Discuss the theories of perception	Definition, importance in forestry extension Carrot and stick theory of Motivation Different methods of motivation Different theories of Perception
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	Definition of Communication and its imprudence in forest extension Different types of communication and their relative advantages and disadvantages Mode of Communication -Print -Audio-visual -Broadcasting, -Indigenous
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	Individual method, group Method and Mass method Advantages and disadvantages
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**
Define teaching aids Discuss importance of teaching aids in extension Prepare and design of Audio-visual aids List basic components of a leaflet/brochure	Various types of teaching aids (Leaflets/Brochures, pamphlets, poster, Overhead, Slide, film, audio)
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 grogram planning List and describe the process of program planning	Definition of program planning and importance 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 Evaluation	**Hrs. theory 15**
Objectives	Content
Tell what is evaluation Describe the importance of Evaluation in forestry extension List the types of evaluation Discuss the criteria of Evaluation List the steps of Evaluation (Developing an evaluation plan, assessing the results, communicating the results and Recommendations) Tell what should be in an evaluation plan?	Different definitions of extension and program evaluation Importance: (For learning and development, for accountability – to show others that you are effective) Qualitative Vs Quantitative Evaluation Internal evaluation External evaluation Preliminary evaluation Formative evaluation Summative evaluation Various components of an Evaluation Plan (EP)
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.	Definition/Concept of gender, equity, justice and rights National and international convention on gender and their agenda and mandate. 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 - natural resources, infrastructure, ecotourism etc	Definition Various issues and challenges of development (economic, political, environmental, geographical and social) Various types of development
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	Definition of participation Case studies of participation Importance of participation 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 brochure/Leaflets/Poster	**Pr. Hrs 16**
Objectives	*Content*
Prepare extension materials	Discuss about how to prepare and finalize extension materials
Practical 2: Prepare slide and power point presentation	**Pr. Hrs 16**
Objectives	*Content*
Prepare slide shows and powerpoint slides	Discuss about how to prepare and finalize extension materials
Practical 3: Prepare questionnaire	**Pr. Hrs 16**
Objectives	Content
Prepare checklist for field survey Conduct household survey, focus group discussion	Discuss about checklist of development for field survey, households survey, focus group discussion and key information interview
Practical 4: Evaluate one of the forestry projects	**Pr. Hrs 30**
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, Law and Office Management

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

Course description

This course combines Forest Policies and Laws (part-I) and Accounting and Office Management (part-II). The first part provides Forest Laws and Forest Polices, Rules and Regulations. The second part 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 forest policy, forest law, rules and regulations, budgetary system, fiscal administration, accounting system of Nepal Government, at the end of the course, the students will be able to:

- 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.
- 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.

Minimum Standards:

Students must achieve a minimum of 40% accuracy in theory and 60% accuracy in practical**.**

Recommended texts and reference books:

- Government budget and Accounting Systems (with audit), B.G Bista & S.N Shrestha, Laligurans Publictations.
- Government Accounting System & Budgetory system in Nepal, M.M Shrestha & M. Bajimaya, Pub. Suman Enterprises.
- Baybasyik Siddhanta Tatha Karyalaya Karyabidhi, Amuda Shrestha (Publisher: Eductional Enterprises).
- Nepal Ain Sangrah, Volume 7, revised.
- Forest Act 2049
- Mulukin Ain 2049

- Nepal Niyan Sangrah, Volume 7, revised.
- Nijamati Sewa Ain and Nijamati Sewa Niyamawali, Publisher: Ministry of Law and Justice, NG. Management Committee of Legal Books.
- Accountin System of NG, M.L Pradhan & S.P Munamkarmi. Publisher: Eductional Enterprises.

Course: Forest Policies, Laws and Office Management (Theory hrs. 78)	
Part 1: Forest Policies and Laws	
UNIT 1: Major Forestry Sector Policies	**Theory hrs: 7**
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
	  • National Forestry Plan, 2033
	  • Master Plan of Forestry Sector 1988
	  • National Conservation Strategy 1988
	  • Revised Forestry Sector Policy 2000.
	  • Nepal Biodiversity Strategy 2002

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 Laws	**Theory hrs: 14**
Sub unit 2.1: Private Forest Nationalization Act, 2013	**Theory hrs: 2**
Objectives:	***Content:***
• Explain objectives and salient features of Private Forest Nationalization Act 2013.	• Objectives and salient features of Private Forest Nationalization Act, 2013

Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Sub unit 2.2: Forest Act , 2049	**Theory hrs: 4**
Objectives:	***Content:***
• Explain objectives and salient features of Forest Act 2049.	• History of development of Forest Act 2049 • Objectives and salient features of Forest act 2049.
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Sub unit 2.3: National Park and Wildlife Conservation Act 2029 and its amendments	**Theory hrs: 3**
Objectives:	***Content:***
• Explain objectives and salient features of National Park and Wildlife Conservation Act 2029	• Historical development of National Park and Wildlife Conservation Act 2029 • Objectives and salient features of National Park and Wildlife Conservation Act 2029
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Sub unit 2.4: Soil and Watershed Conservation Act, 2039.	**Theory hrs: 3**
Objectives:	***Content:***
• Explain objectives and salient features of Soil and Watershed Conservation Act, 2039.	• Brief introduction to Soil and Watershed Conservation Act, 2039 • Objectives and salient features of Soil and Water Conservation Act

Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Sub unit 2.5: Plant Protection Act ,2029	**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 3: Forestry Rules, Regulations and Guidelines	**Theory hrs.: 14**
Sub unit 3.1: Forest Regulation, 2051	**Theory hrs: 2**
Objectives:	***Content:***
• Explain the objectives, sales and distribution procedure arranged by Forest Regulation, 2051	• Introduction and objectives of Forest Regulation 2051 • Rules and procedures of forest produces sales and distribution
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Sub unit 3.2 Guidelines for the Community Forestry Development Program	**Theory hrs 2**
Objective	**Content**
Explain facilitator's role in community forestry development program.	**Guidelines for the Community Forestry Development Program, 2058 (revised)**
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and

	reference books
Sub unit 3.2: National Parks and Wild life Rules and Regulations	**Theory hrs: 3**
Objectives:	***Content:***
• Explain objectives and salient features National Parks and Wild life Rules and Regulations and its amendments.	• National Parks and Wildlife Conservation Regulation, 2030 • Himalayan National Park Regulation, 2036 • Conservation Area Management Regulation, 2050 • Buffer Zone Management Regulation, 2052 and its Guidelines
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Sub unit 3.3: Legal procedures and charge sheets	**Theory hrs: 3**
Objectives:	***Content:***
• Explain the legal procedures and development of charge sheet as provided authorizes by the prevailing laws and regulations.	• Legal procedures • 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 4: Forestry related treaty and convention	**Theory hours 4**
Objectives:	***Content:***
• 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 biodiversity 1992 • UN Convention on Climate Change 1992 • Convention on Desertification 1994 • Kyoto Protocol 1998 & • ITTO
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books

Part II: Accounting and Office Management	
UNIT 1: Government Fiscal Administrative Procedure	**Theory hrs: 15**
Sub unit 1.1: New Govt. Accounting System	**Theory hrs: 4**
Objectives:	***Content:***
• Explain the history, objectives and salient features of new government accounting system.	• Historical background and objectives of new government accounting system • Salient features 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
Sub unit 1.2: Major accounting types and ledgers	**Theory hrs: 4**
Objectives:	***Content:***
• Introduce different types of accounting ledgers and forms used by the	• Introduction of different types of accounting ledgers and forms

government of Nepal.	
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Sub unit 1.3: Government Budget Formulation Procedure	**Theory hrs: 4**
Objectives:	***Content:***
• Introduce historical backgrounds, definitions, and objectives of the government budget. • Explain procedure of government budget formulation procedures.	• Historical backgrounds, definitions, objectives of the government budget • Formulation of government budget and its execution
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books
Sub unit 1.4: Inventory Accounting and Procurement System	**Theory hrs: 3**
Objectives:	***Content:***
• Introduce meaning, objectives inventory accounting • Explain procedure of government procurement system..	• Meaning, objectives inventory accounting • Classification of inventory goods • Government procurement system
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books

Course: Forest Policy and Office Management	
Part II: Accounting and Office Management	
UNIT 2: Official Procedures	**Theory hrs: 9**
Objectives:	***Content:***
• Explain and explain the general official procedures in reference with	• Historical background and objectives of new government accounting

government of Nepal.	system • Official correspondence, filing, and indexing (3) • Authority letter, tippani (decision making procedures), • Muster roles form, • Petty cash
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: 5**
Objectives:	***Content:***
• Explain and explain the financial rules and procedures in reference with government of Nepal.	• Payment of salary and 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 and features of civil service act and regulations
Evaluation methods: oral and written tests and home assignments	***Teaching / learning activities & resources:*** classroom instruction, illustrations, diagrams, visuals textbooks and reference books

Computer Application

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

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 multi media, Web, Email and Internet, Virus and anti-virus definitions, Geographic Information System (GIS) and its application in forest and natural resource management.

Course Objectives

- Gain knowledge and skills on computer application and GIS application
- Able to prepare word documents
- Able to do preliminary calculations and analysis in spreadsheet
- Able to prepare graphics and presentation slides
- Able to work on GIS domain for the application of forestry and natural resource management

Minimum Standards

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

Recommended Texts

Fundamentals of Geographic Information System – Michael E. Demers
GIS for Beginners – ICIMOD
Introduction to ArcView GIS – ESRI
Getting to know ArcView GIS – ESRI
Principles of GIS – Peter A. Burrough and Rachael A. McDonnell

Course: Computer application for forestry	**Hrs. theory 78** **Hrs. Practical 78**
Unit 1 Introduction to computer	***Hrs. theory 8***
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	• 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 Edit the document Print the final document	• Document creation • Formatting, proof reading, editing • 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 11**
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 • 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 11**
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, SVG…
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 Introduction to GIS	***Hrs. theory 11***
Objectives	Content
Define GIS. Answer "What GIS can answer" List the components of GIS Define GIS terminologies. List the types of GIS	• Define GIS • Scope and importance of GIS • Components of GIS • GIS terminologies • Use of maps • Map reading • GIS software • Types of GIS
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 Vector and Raster GIS	**Hrs. theory 9**
Objectives	Content
Describe the vector and Raster GIS Explain about the vector and raster representation of data List vector and raster models Explain about database management system in vector and Raster GIS	General definitions/ Introduction Vector and Raster representation of data Vector raster models of GIS Database
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
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 8 GIS application	**Hrs. theory 12**
Objectives	Content
List the applications of GIS Explain about the application of GIS in forestry and natural resource management sector	• Mapping locations • Mapping quantities • Mapping densities • Finding distances • Mapping and monitoring changes • Modeling and prediction • Spatial analysis • Application of GIS in forestry sector and natural resource management

Computer Application ,Practicals:

Course: Computer Practicals	**Lab Hrs 78**
Practical 1: Typing Tutor	Hrs 5
Objective	*Content*
Complete typing tutor	Type English Fonts Type Nepali Fonts
Practical 2: Work on DOS	Hrs 5
Objective	*Content*

Tutorial on Disk Operating System	***Disk Operating Systems***
Practical 3: Work on MS Word 2006	Hrs 14
Objective	*Content*
Carry hands on Microsoft Word	Document creation Document formatting Document saving Document editing Document printing
Practical 4: Work on MS Excel 2006	Hrs 10
Objective	*Content*
Carry tutorials on MS Excel	Data entry in spreadsheet Data analysis Graphical presentation of data Tabulation and Printing
Practical 5: Work on MS Power point 2006	Hrs10
Objective	*Content*
Carry tutorials on MS Power Point	Slide preparation Design, multimedia, proofreading, editing Saving and Opening Presentation and printing
Practical 6: Work on ArcView 3.x	Hrs17
Objective	*Content*
Carry hands on ArcView 3.x	Layer creation Editing GIS data Database management in GIS Sybolization and Labelling Layout preparation and Printing
Practical 7: Work on ERDAS Imagine 9.X	Hrs17
Objective	*Content*
Carry hands on ERDAS Imagine 9.x	Layer creation Editing GIS data Database management in GIS Sybolization and Labelling Layout preparation and Printing

Entrepreneurship Development

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

Course Description:

This elective course intends to give exposure to students practically in identification of NTFPs and other forest-based enterprise development. At the end of this course, students will be able to identify and prioritize forest based enterprise list including timber and NTFPs in respective areas, prepare a comprehensive enterprise development plan.

Course Objectives:

- Identify major forest products of respective areas i.e. NTFPs, timbers, fibers
- Prepare a list of major forest based enterprises
- Prioritize potential forest based enterprises
- Prepare a comprehensive enterprise development business plan

Minimum Standards:

Students must achieve a minimum of 40% accuracy in written exam and 60% accuracy in practical**.**

Text and reference Books

- Improvcing Forest Benefits for the poor: Learning from community- based forest enterprises in Nepal -Dr. Bishnu Hari Pandit, Adrian Albano and Chetan Kumar
- Community -Based tree and Forest Product Entreprises: Market analysis and Development- Prepared by Isabelle Lecup and Ken Nicholson SNV/FAO/RECOFTC/ASNSAB
- Nepalma Tarkari Kheti - DOA HMG/Nepal, Khumaltar
- Cultivation and Utilization of Medicianal and Aromatic Plants - C. K. Atal and B. M. Kapur
- Fruits- Tropical and sub-tropical - T. K. Bose and S. K. Mitra
- Pro-poor Value Chain Development for High Value Products in Mountain Regions: Indian Bay Leaf By ICIMOD

Course: Forest Entrepreneurship Development (Theory hours 117 and practical hours 78)	
Unit: 1: Introduction to Enterprise	Hrs. theory 15
Objectives	Content
Define enterprise and list different types of enterprises Discuss about the Feasibility study of an enterprise. Discuss about the components of a Successful business plan from a case study	-Definition and different types of enterprise - Feasibility study of an enterprise -Sensitivity analysis -Market analysis -Technical analysis -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, illustrations, diagrams, visuals, textbooks and reference books, Journals and publications.
Unit-2: Forest based enterprise identification and prioritization	Theory hrs: 15
Objectives:	Content:
• Identify and prioritize forest based enterprises. • Explain the legal procedure of a Timber and Non-timber based enterprise registration. • Discuss about the marketing approach and issues and constraints of marketing • Discuss Issues-based and policy constraints for enterprise development	• Feasibility study of enterprises • Identification and prioritization forest based enterprises • Criteria for enterprise prioritization • Enterprise modalities: issues and constraints of forest based enterprise development, and product marketing • Policy and Legal issues of timber and non-wood forest based enterprises.
Evaluation methods: Supervision, field report and written test.	Teaching / learning activities & resources: Class room discussion, field visit, practice in field, attachment with projects, involve in usual activities

Unit-3: Value chain of forest products based enterprises	Theory Hrs 20
Objectives: • Explain the value chain of forest based enterprises. • Discuss about the actors of value chain of wood and non-wood enterprises. • Discuss about income and employment generated by value addition process of forest based enterprises. • Environmental impacts of value chain	Content: • Define value chain in forest based enterprises • Mapping the value chain • Actors of value chain • Income and employment generated by value chain in wood and non-wood enterprises • Impacts of value chain in forest based enterprises
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-4: Business planning	Theory hrs:25
Objectives: • Explain the business plan • Discuss about the elements of business. • Discuss about methods for preparing a business plan of forest based enterprises. • Develop a business plan of a wood or non-wood enterprise.	Content: • Define business plan • Elements or framework of a business plan • Methods for preparing a business plan of forest based enterprises. • Prepare a business plan of a wood or non-wood enterprise.
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: Economic analysis of an enterprise	Theory hrs:25
Objectives	Content
• Explain the basic principle of economic analysis of an enterprise. • Discuss about economic evaluation	• Define economic analysis of an enterprise • Profitability analysis

criteria. • Discuss about profitability analysis • Develop a business plan of a wood or non-wood enterprise.	• Interest rate • Calculation of values of profitability (net income, net return, gross return, net present value, breakeven point, And internal rate of return etc.
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-6 Selection of Enterprise, and coordination and linkages for rural enterprise development	Theory hrs: 17
Sub unit 6.1: Selection of an enterprise	Theory hrs:13
Objectives: • Discuss about the enterprise operation process and practices • Discuss about issues and constraints of the selected enterprises.	Content: • Enterprise operation process and practices • Issues and constraints of wood or non-wood enterprises. • How to prepare forest enterprise development guidelines at the local level
Evaluation methods: Supervision, field report and written test.	Teaching / learning activities & resources: Class room discussion, field visit of selected wood and non-wood enterprises, practice in field, attachment with projects, involve in usual activities
Sub unit 6.2 : Coordination and linkages	Theory hrs:4
Objectives: • Discuss about the role coordination and linkages for enterprise development and management	***Content:*** • Define coordination and linkages • Identification of stakeholders(Venn diagram) • Importance of coordination and linkages for enterprise development and management
Evaluation methods: Supervision, field report and written test.	Teaching / learning activities & resources: Class room discussion, field visit of selected wood

	and non-wood enterprises, practice in field, attachment with projects, involve in usual activities

Forest 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.
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.	• 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 business plan of a forestry based enterprise	Practical hours: 10
Objectives:	*Content:*
• To learn and practice about forestry business plan preparation and implementation.	• Develop business plan of an enterprises to be operated by wood and non-wood 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 operating a selected wood or non-wood enterprise and empower on coordination and linkage process	Practical hours: 48
Objectives:	***Content:***
• 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 operating a selected wood or non-wood enterprise. • Enhance skill on coordination and linkages
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, attachment with projects, involve in usual activities

Field Practice

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

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%, Training/ field supervisor -25% and host organization-25%

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