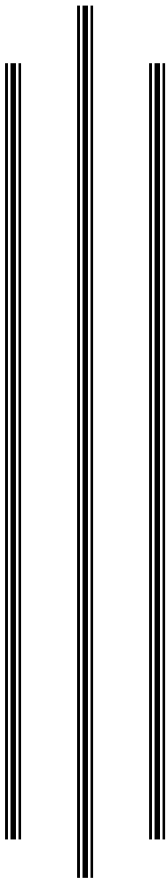
CURRICULUM

FOR

DIPLOMA IN AGRICULTURE

(Intermediate of Science in Agriculture)

Major: Animal Science



Council for Technical Education and Vocational Training (CTEVT)

Curriculum Development Division

Sanothimi, Bhaktapur

May, 2014

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Mission

Produce sufficient number of middle level technical manpowder in the field of Livestock Management and Animal Health to meet the national requirements and the demand of foreign employment sector.

Strategy

Achieve mission of educational excellency by maintaining proper infrastructure, lab facilities, qualified and experienced teachers/ faculties through a sound curriculum and ultimately to produce competent graduates.

Specifically, revise and implement currulum periodically to cover overall aspects of modern livestock farming including animal health and husbandry practices, extension education, social mobilization, community development etc. in order to produce middle level first hand technical manpower required in private and government Livestock Farms, Commercial Poultry Farms, Pigery, Fish and Fishery, Sheep and Goat Farms, Rabitry, Pet Animals and Equine Care Center and Dairy Indurtries which ultimately help to improve livestock economy and national GDP.

Philosophy

Application of modern scientific tools and techniques in livestock development sector addressing present needs and future generation issues.

Programme Description

The Diploma in Agriculture (Intermediate in Science in Agriculture) major in animal Science course is of 3 years duratuion. First year covers basic sciences, maths and languages which provide base for the study in subsequent years and also provide the base for bachelor level study in related field. Second year courses are of mixed type which covers common agriculture related courses such as Extesion and Community development, Elimentary Statistics and basic Computer Sciences, Agribusiness Management and Marketing, Aquaculture, Introductory Plant Science and some specialized courses of animal sciences such as Animal Nutrition and Fodder Production, Sheep and Goat production, Animal Health I (clinical medicine) and Animal Housing and Environmental Sciences. Third year courses are totally related to animal husbandry and veterinary sciences which include Animal Health II(preventive veterinary medicine), Commercial Dairy Farming, Dairy and Animal Product Technology, Commercial Poultry Production, Veterinary Laboratory Techniques, Equine, Rabit and Pets, Veterinary Clinical Practice and Work Experience Program (WEP).

Aim and Objectives of the program

Aim

Produce competent mid-level human resources equipped with sufficient knowledge and skills in agriculture, basic veterinary Science, animal husbandry and related subjects

Objectives

The specific objectives are:

1. Provide sufficient knowledge of basic sciences (physics, chemistry, biology), maths and languages so that the graduates can compete with +2 science students in bachelor level study

2. Provide sufficient knowledge and skills of community actions and social mobilization so that they can work as extension worker in the community.
3. Provide knowledge and skills in care and management of major domesticated livestock species and pets.
4. Provide basic knowledge and skills of animal health and hygiene required for field veterinary services.
5. Produce competent graduates who can work as veterinary para-professional under the guidance and responsibility of veterinarians.

Conceptual Framework

The major focus of this programme is to produce qualified middle level manpower in animal health and livestock production field, which can provide technical guidendance and support to the livestock and dairy farmers, fishery entrepreneurs and pet owers. It will also creates employment opportunities and improve equitable livelihood of farmers especially underprivillage societies including women and other disadvantage groups of the community. The course structure deals with theory and practical aspects of animal husbandry and veterinary sciences.

The course will have two components: Basic c**ore course and specialized course**. The basic science courses are termed as core course and all agriculture/ animal science/veterinary science related courses are termed as specialized course. The first year is designed focusing with basic sciences: Physics**,** Chemistry**,** Botany, Zoology and Mathematics, Nepali and English. The subjects for second year include the courses of basic agricultural subjects and animal science related specialization subjects. While the third year is totally animal science and veterinary related specialized courses which are mentioned above in program description.

Finally, the course should reflect:

- the need of present Agriculture/Veterinary services
- the professionalism in livestock sector
- the need based curriculum so that the graduates of this couse will be readily acceptale by the farmers at community level
- the roles and responsibilities of Agriculture/ Vet TECHNICIAN to improve the livestock economy of the country

Target Groups

SLC passed graduates with minimum second division marks

Group Size

40 students in one batch

Entry Criteria

The entry requirements:

- SLC passed certificate with minimum second division marks.
- Should appear and pass the entrance test conducted by the CTEVT.
- Admission will be made on the basis of merit list within the quota as fixed by the CTEVT policies.

- Following documents should be submited by the applicant along with the application form for entrance test and also for admission process:
    - SLC passed certificate (with at least second division marks)
    - Character certificate
    - Citizenship certificate(only for verification of date of birth, name , fathers name and address)

Medium of Instruction

The medium of instruction will be English for all the subjects except Nepali subject of first year.

Course Duration

Course duration= 3 years (including 3 months WEP).
One academic year = 32 academic weeks.
One week= 40 hrs
One year = 40 hrs*32=1280 hrs

Pattern of attendance

At least 90% attendance record for classroom teaching and 95 % for fieldwork/WEP is required to be eligible to appear in annual/ final examinations.

Teacher and student ratio

The ratio between teachers and students must be:

- 1:40 for theory and tutorial class
- 1:10 for practical class.

The Qualifications of Coordinator, Teacher and Demonstrator:

- The program coordinator must be a master degree holder in related field or he/she will have Bachelor degree in related field with minimum of 5 years teaching experience after completion of the Bachelor degree.
- The teacher faculty must be a bachelor's degree holder in technical subjects and masters digree for basic sciences and other non technical subjects
- The demonstrator should have an intermediate level degree in related subject with minimum of 2 years experience
- Minimum of 75% of the teachers must be fulltime.

Teaching learning materials

- **Printed materials*:*** Assignment sheets, case studies, handouts, performance checklists, textbooks etc.
- **Non-projected materials*:*** Displays, models, photographs, flipchart, poster, writing board etc.
- **Projected media materials***:* Slides, overhead projectors, transparency, opaque projections etc.
- **Audio-visual materials*:*** Audiotapes, films, slide-tapes, video disc, video tapes etc.
- **Computer based instructional materials*:*** Computer based training, interactive video etc.

Teaching learning methodologies

Lecture, group discussion, demonstration, simulation, role play, guided practice, practical work, field visits, laboratory observation and work, report writing, term paper presentation, case analysis, tutoring etc. Categorically the teaching and learning methodology will be as follows:

- Theory: Lecture, group discussion, assignment and group work
- Practical: Demonstration, observation and self-practice.

Disciplinary and Ethical Requirements

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

Evaluation 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 75% and 25% respectively
- ❖ The theoretical and practical assessment format must be used as per CTEVT developed format 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 75% and 25% 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 Agriculture /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.
- ❖ Provision of re-examination shall be as per CTEVT policy.

Pass Marks

The pass marks for both theory and practical will be 40 % of full marks

Grading System

The following grading system will be adopted:

- Distinction: 80% and above
- First division: 65% to below 80%
- Second division: 50 % to below 65%
- Pass division: 40% in aggregate

Certification

The council for technical education and vocational training will award certificates in **"Diploma in Agriculture (I.Sc.Ag.) Major in Animal Science"** to the candidates who successfully complete the requirements as prescribed by the CTEVT.

Career Path

The graduates would be eligible to work as mid-level technicians (Junior Technician, JT) in department of livestock services and related sector as prescribed by the Public Service Commission or the concerned authorities. The graduates will be eligible to apply for the entrance examination to study B Sc Ag and B V Sc & AH , B Sc Animal science and other related programs of PU, TU and other recognized universities of Nepal and abroad.

Course Structure

Year 1 General

SN	Subject	Credit hours/week	Contact Hours/week	Full Marks
1	English	5+0	5	100
2	Nepali	5+0	5	100
3	Physics	4+1	6	100
4	Mathematics	6+0	6	100
5	Chemistry	4+1	6	100
6	Botany	4+1	6	100
7	Zoology	4+1	6	100
	Total	32 + 4	40	700

Year 2 Major: Animal Science

SN	Subject	Credit hour/week	Contact hour/week	Full marks
1	Extension and Community Development	3+1	5	100
2	Agribusiness Management and Cooperative	3+1	5	100
3	Aquaculture and Fisheries	2+1	4	100
4	Statistics and Computer Application	2+1	4	100
5	Introductory Plant Science	2+1	4	100
6	Animal Nutrition and Fodder production	3+1	5	100
7	Animal Housing and Environmental Science	2+1	4	100
8	Animal Health l	3+1	5	100
9	Sheep, Goat and Swine Production	2+1	4	100
	Total	22+9	40	900

Year 3 Major: Animal Science

SN	Subject	Credit hour/week	Contact hour/week	Full marks
1	Commercial Dairy Farming	3+1	5	100
2	Animal Health ll	3+1	5	100
3	Dairy and Animal Product Technology	2+1	4	100
4	Poultry Entrepreneurship	2+1	4	100
5	Veterinary Laboratory Techniques	2+1	4	100
6	Animal Breeding and Artificial Insemination	2+1	4	100
7	Equine, Rabbit and Pet Animals	2+1	4	100
8	Veterinary Clinic Practices	0+1	2	50
9	Work Experience Program (WEP)	0+4	8	300
	Total	16+12	40	1050
	Grand Total for Animal Science	90		2650

Note: 1. Work Experience Program: 3 months (3 months *4 weeks*40 hours = 480 hours)

2. The contact hours of third year subjects must be 40 hours/week.

3. WEP should be completed before third year final examination.

4. The WEP plan is attach herewith.

Detail of creadit hours and marks for Diploma in Agriculture (Animal Science)

First year

SN	Subject	Mode		Weekly hours	Distribution of Marks						Total Marks
					Theory			Practical			
		T	P		Internal	Final	Time	Internal	Final	Time	
1	English	5	0	5	20	80	3	-	-	-	100
2	Nepali	5	0	5	20	80	3	-	-	-	100
3	Physics	4	2	6	16	64	3	8	12	3	100
4	Mathematics	6	0	6	20	80	3	-	-	-	100
5	Chemistry	4	2	6	16	64	3	8	12	3	100
6	Botany	4	2	6	16	64	3	8	12	3	100
7	Zoology	4	2	6	16	64	3	8	12	3	100
	Total	***32***	***8***	***40***							***700***

Second Year

SN	Subject	Mode		Weekly hours	Distribution of Marks						Total Marks
					Theory			Practical			
		T	P		Internal	Final	Time	Internal	Final	Time	
1	Extension and Community Development	3	2	5	16	64	3	8	12	3	100
2	Agribusiness Management and Cooperative	3	2	5	16	64	3	8	12	3	100
3	Aquaculture and Fisheries	2	2	4	16	64	3	8	12	3	100
4	Statistics and Computer Application	2	2	4	16	64	3	8	12	3	100
5	Introductory Plant Science	2	2	4	16	64	3	8	12	3	100
6	Animal Nutrition and Fodder production	3	2	5	16	64	3	8	12	3	100
7	Animal Housing and Environmental Science	2	2	4	16	64	3	8	12	3	100
8	Animal Health I	3	2	5	16	64	3	8	12	3	100
9	Sheep, Goat and Swine Production	2	2	4	16	64	3	8	12	3	100
Total		***22***	***18***	***40***							***900***

Third Year

SN	Subject	Mode		Weekly hours	Distribution of Marks						Total Marks
					Theory			Practical			
		T	P		Internal	Final	Time	Internal	Final	Time	
1.	Commercial Dairy Farming	3	2	5	16	64	3	8	12	3	100
2.	Animal Health ll	3	2	5	16	64	3	8	12	3	100
3.	Dairy and Animal Product Technology	2	2	4	16	64	3	8	12	3	100
4.	Poultry Entrepreneurship	2	2	4	16	64	3	8	12	3	100
5.	Veterinary Laboratory Techniques	2	2	4	16	64	3	8	12	3	100
6.	Animal Breeding and Artificial Insemination	2	2	4	16	64	3	8	12	3	100
7.	Equine, Rabbit and Pet Animals	2	2	4	16	64	3	8	12	3	100
8.	Veterinary Clinic Practices	0	2	2	-	-	-	20	30	3	50
9.	Work Experience Program	As per WEP rules									300
	Total	***16***	***16***	***32***							***1050***

First Year

1. English
2. Nepali
3. Physics
4. Mathematics
5. Chemistry
6. Botany
7. Zoology

English

Credit Hour: 5 **Full Marks**: 100

Total hours: 160

General objectives: This course is designed with a view to provide students with techniques in the use of English for academic and communicative purposes, train them in the functional, notional and grammatical areas of English language uses, make them see the relationship between structure and meaning and teach them structures in a context. This course will to lead students from Intermediate to upper level of English proficiency and guiding them from general to comprehensive understanding of written tasks.

Unit 1: Core English-

The core English text for teaching language skills contains the following units:

Course Introduction	**Time hour** **1**
Core English	**Time hours** **15×6 = 90**
Unit 1: Experiences and achievements	**Theory** **Time hrs** **6**
Objectives	Contents
Make sentences using past simple and present perfect continuous Express new experience using active and passive gerund	Was/were/did/had visited/have visited /have you ever visited/ shouted/ have you ever been shouted have/has ever/never be used + singing be used + being invited be used + having something done
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: Appearances	**Theory** **Time hrs** **6**

Objectives	Contents
Judge someone from appearance using sense verbs Describe peoples' physical appearance	Look+adjective Look like+ noun Look+as if/ as though + clause Seem to be + adjective Seem to be+to v1 Seem to be+have+v3 Has/has got
Unit 3. Relating past events	**Theory Time hours 6**
Objectives	Contents
Describe earlier events using past perfect tenses Use non defining relative clause	Had stopped/had been stopped Had been trying/had done Who/whom/which/where/when
Unit 4. Attitudes and Reactions	**Theory Time hrs 6**
Objectives	Contents
Express attitude using verb and adjectives Express attitude strongly Express person's character	X annoys me I am/get annoyed by X I find X annoying. If there is one thing+subject or object +relative clause One thing/ what/ The thing that +attitude verb +me about them is the way+clause
Unit 5. Duration	**Theory Time hrs 6**
Objectives	Contents

Make questions using duration structures How long?, for/until, in/by Make sentences using take and spend in activities and achievements Make sentences with take, spend and depends on	How long did you play cards for? How long did you spend playing cards? How long did it take to write an essay? X didn't happen for /till(time) It was (time) before X happened. How long does it take to…….? It can take/ takes….to…..
Unit 6. Reporting	**Theory Time hrs 6**
Objectives	Contents
Change tenses involved in reported speech Report the sentences using special reporting verbs	Is going to/= was going /would Present = past Present perfect} Past }= Past perfect Past perfect } Speaker+ said/admitted/denied etc that Speaker+ assured/warned/told me that Speaker accused + listener(me)of+v4 Speaker agreed/refused etc to +v1 Speaker advised/urged/begged me to + v1 Speaker suggested that I should +v1 Speaker insisted on +v4
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 7: Deductions and explanations	**Theory Time hrs 6**
Objectives	Contents

Make deductions Give reasons using conditionals with ***if***	**must, may/might, can't+ present infinitives** I'm sure he works/doesn't work hard - He must/ can't work hard I'm sure he works/doesn't work hard – He must be / can't be working hard. I'm sure he was working hard- He must have been working hard Perhaps he is at home – He may/ might be at home. He can't be a doctor because he didn't know what hepatitis was.
Unit 8: Advantages and disadvantages	**Theory Time hrs 6**
Objectives	Contents
Describe the things using effect verbs Listing advantages and disadvantages Advise on a course of action in terms of its advantages and disadvantages	Subject+enable/allow/encourage/force+someone to do something Subject+make it easier for someone to do something Subject+stop/prevent/save/discourage +someone from doing something The /one/the main/another+ disadvantages of/drawback of+being being unemployed is that…. There is no point in+v4 You ought to/ ought not to/might as well+v1
Unit 9: Clarifying	**Theory Time hrs 6**
Objectives	Contents

Ask questions to get information Make indirect questions Form tag questions	What kind of/ sort of/….? What colour/size/flavor…? How..? Which…? Whose…? What…? How many…? How far….? Do you know / Have you any idea/ Can you remember/ I wonder where he went? Didn't he? Wasn't he? Wasn't it?
Unit 10: Wishes and regrets	**Theory Time hrs 6**
Make a wish or express dissatisfaction Make sentences using second conditional structures Express regret.	I wish/ If only + would… I wish/ If only +I/We could I wish/ If only +Past tense If …..Past tense, I would/wouldn't +v1 I wish/ If only +Past Perfect tense I should (shouldn't) have done If +Past Perfect…would(n't) have done Could/needn't have done
Unit 11: Events in sequence	**Theory Time hrs 6**
Objectives	Contents

Narrate the events in sequence Write the events in right(expected) and wrong order(unexpected) Talk about an unexpected event following immediately on another.	As soon as/When +past simple As soon as /When/After+Past Perfect He did X before he did Y He didn't do Y until he had doneX He didn't do X before he did Y He did Y before he'd done X ….had only just…when No sooner had….than…
Unit 12: Comparison	**Theory Time hours 6**
Objectives	Contents
Compare the things to show the differences Compare numerically using dimension nouns and adjectives Make comparison with different tenses	Much/ a lot/ far more…than../ a little/ a bit/ slightly more..than../almost/ nearly as…as.. not quite/ not nearly as..as… …..is about three times as expensive as…. …..is about three time the price of …… ……costs about three times as much as…… ……..is about a third as expensive as/ the third of ….. As +adjective+as The +noun +of The weather was worse last year than it <u>is</u> this year/ it should have <u>been</u>/ you said it would <u>be</u>/ I had expected it to <u>be</u>
Unit 13: Processes	**Theory Time hrs 6**
Objectives	Contents
Connect two types of sequence Emphasize the right order Give instruction	When +Present simple When +Past perfect You should do X before you do Y You shouldn't do Y before/until you've done X

Vocabulary: Natural process: melt, dissolve, evaporate freeze, condense, congeal	
Unit 14: Prediction	**Theory Time hrs 6**
Objectives	Contents
Express probability in prediction Make sentences using conditional predictions- If ,unless, As long as ,Provided	He will certainly/definitely- is sure to He will probably- is likely to He probably won't- is unlikely to He certainly/definitely won't If / As long as/ Provided + he works hard' he will probably pass the exam Unless he works hard he is unlikely to pass.
Unit 15: News	**Theory Time hrs 6**
Objectives	Contents
Make news of recent events Make questions for finding out news Indicate that the information is based on hearsay Give second hand information	Present perfect simple Past simple and continuous Present perfect Continuous When/where/how did it happen? Apparently/they say//I'm told + sentence Be supposed to +infinitives He is supposed to be poor It is estimated/thought/believed/said that..
Unit 2: Extensive Reading and Writing	Theory Hrs. (15+24+24+4 = 67)
Objectives	
Have 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	
Contents	Objectives
Poems	Theory hrs. (5×3 = 15)

	• The grandmother, Ray your Bear • The Lamentation of the old Pensioner, W.B. Yeats. • Full fathom five thy father lies, Shakespeare • Travelling Through The Dark, William Stafford. • God's Grandeur, Gerard Manley Hopkins
Story	Theory hrs. (6×4 = 24)
	• About love, Anton Chekhov • A story, Dylan Thoma • The Last Voyage of the Ghost Ship • The Tell-tale Heart, Edgar Allan Poe • Hansel & Gretel, Jacob & Wilhelm Grimm • The Boarding House, James Joyce.
Essays	Theory hrs (6×4 = 24)
	• Two long-term problems; Too many people; Too few trees, Moti Nissani. • Hurried Trip to Avoid a Bad Star, M. Lilla and L. Bishop Berry. • I have a Dream, Martin Luther King, Jr. • Women's Business, Ilene Kantrov • The Children Who Wait, Marsha Traugot. • A Child is Born, Germaine Greer.
Drama	Theory hrs (1×4 = 4)
	• Purgatory, W.B. Yeats.
Internal Assessment	Time hours 2

Evaluation Scheme:

This paper carries 100 marks, which will be divided as follows.

Core English – 60 %

Extensive Reading and Writing – 40%

Skill wise weight age will be on follows:

Reading	-35 %
Writing	-35 %
Grammar and language use	-30 %

Time Planning:

Course introduction	1
Core English	15×6 = 90
Extensive Reading	67
Internal assessment	2
Total hrs	160

Prescribed Texts:

1. Doff, Adrian, Christopher Jones, Keth Mitchell, Meanings into Words (Upper Intermediate) Student's Book and Work Book, Cambridge: Cambridge University Press, 1984.
2. The Heritage of Words: Ekta Books, Kathmandu, 1996.

अनिवार्य नेपाली

पाठ्यभार : ५ घण्टा प्रति हप्ता **कुल पूर्णाङ्कः १००**

कुल समय : १६० घण्टा

परिचय र उद्धेश्यः यो पाठ्यांश कृषि र पशुविज्ञान डिप्लोमा (प्रवीणता) तहमा अध्ययन गर्ने विद्यार्थीहरुमा नेपाली भाषासम्बन्धी आधारभुत क्षमताको विकासको लागि राखिएको हो । यो पाठ्यांश पूरा गरेपछि विद्यार्थीहरु निम्नलिखित कुरामा सक्षम हुनेछन् :

१. स्तरअनुरुप संबद्ध विषयक्षेत्रमा प्रयोग हुने कथ्य र लेख्य नेपाली भाषासम्बन्धी बोध र अभिव्यक्ति क्षमता बढाउन ।

२. सम्बद्ध विषयक्षेत्रका पुस्तक, पत्रिका, लेख आदि सामग्री पढी स्तरीय भाषामा बुँदा टिपोट, संक्षेपीकरण, विवेचना र समीक्षा गर्ने क्षमता वृद्धि गर्न ।

३. संबद्ध व्यावहारिक सन्दर्भका अनुच्छेद, चिठी, सूचना, विज्ञापन, निबन्ध, टिप्पणी आदि प्रयोगमा देखिएका भाषिक त्रुटिहरुप्रति सचेत भई तिनको निराकरणतर्फ उन्मुख हुन् ।

४. वर्णविन्यास र वाक्यतत्वसम्बन्धी स्तरीय भाषामा भाव अभिव्यक्त गर्ने क्षमता प्राप्तगर्न ।

खण्ड क : व्याकरण अंक ५० **पाठ्यभार ६०**

एकाइ १. वर्ण र अक्षरको संरचनाको पहिचान अंक : ५, पाठ्यभार ५

वर्ण र वर्णविन्यास :

(क) उच्चार्य वर्णहरुको परिचय :

- नेपाली स्वर र व्यन्जन बर्णहरुको परिचय र वर्गीकरण (उच्चारणस्थान, प्रयत्न, घोषत्व र प्राणत्वका आधारमा)
- देवनागरी लिपि र कथ्य नेपाली वर्णहरु

ख) नेपाली उच्चरित अक्षरहरुको संरचना

स्वर र व्यञ्जनको शब्दगत अक्षर संरचना र अक्षर सख्या ।

एकाई २: वर्णविन्यास र चिन्ह परिचयः अंक ५, पाठ्यभार ६

क) कथ्य र लेख्य नेपाली भाषामा भिन्नता

ह्रस्व-दीर्घ (इ, उ), स/श/ष, ब/व, व/ओ, य/ए, ऋ/रि, क्ष/छे, क्ष्य/छ्य, शिरविन्दू र चन्द्रविन्दू, हलन्त, पदयोग र पदवियोग तथा लेख्य(चिन्ह सम्बन्धी अशूद्धि(सशोधन अभ्यास

ख) तत्सम, तद्भव र आगन्तुक शव्दका सन्दर्भमा नेपाली वर्णविन्यासको ज्ञान र अभ्यास ।

अ) ह्रस्व र दीर्घ (इ ई, उ ऊ) सम्बन्धी नियम र अपवादहरु

आ) श, ष, स,

इ) ब् , व्

ई) व्/ओ, य/ए, ऋ/रि, क्ष/छे, क्ष्य/छ्य,

उ) ङ्, ञ्,ण्, न्,म्, तथा शिरविन्दु र चन्द्विन्दु

ऊ) हलन्तसम्बन्धी नियम र अपवादहरु

ए) पदयोग र पदबियोगसम्बन्धी नियमहरु

ऐ) तत्सम शब्दका सन्दर्भमा उपसर्ग र प्रत्ययसम्बन्धी वर्णविन्यास ।

ग) लेख्य चिन्हहरुको प्रयोग: पूर्णविराम, अल्पविराम, अर्धविराम, प्रश्नबोधक विस्मयादिबोधक, निर्देशक, कोष्ठ र उद्धरणसम्बन्धी चिन्हको ज्ञान र अभ्यास ।

एकाई ३: शब्दवर्ग र शब्दरुपायन: अंङ्क:१० पाठ्यभार: १२

क) स्रोत: तत्सम, तद्भव र आगन्तुक, व्युत्पादन: पूर्वसर्ग (उपसर्ग), परसर्ग (प्रत्यय), समास र द्वित्व (विभिन्न शब्दवर्ग वा पदको स्रोत बनोट र कार्यका आधारमा शब्दहरुको ज्ञान, पहिचान र अभ्यास ।)

ख) नाम, सर्वनाम, विशेषण, क्रियापद, क्रियायोगी, नामयोगी, संयोजक, विस्मयादिबोधक र निपातजस्ता शब्दवर्ग वा पदकोटिहरुको सोदाहरण परिचय, पहिचान र अभ्यास ।

ग) रुपायन: नाम, सर्वनाम र विशेषणको लिङ्ग, वचन र आदरका आधारमा रुपायन र रुपावलीको सोदाहरण, परिचय र अभ्यास ।

घ) लिङ्ग, वचन, पुरुष, आदर, काल, पक्ष, भाव, वाच्य र अकरणका आधारमा क्रियापदका रुपायनको सोदाहरण परिचय र अभ्यास ।

एकाई ४ : शब्दनिर्माण (सन्धिसहित) अंङ्क : १० पाठ्यभार : १२

क) शब्द र शब्दव्युत्पादनको प्रक्रिया, मूल शब्द र व्यूत्पन्न शब्द (पूर्वसर्ग, परसर्ग, समास र द्वित्व प्रक्रिया): व्युत्पादन र रुपायनको भिन्नताको ज्ञान र अभ्यास ।

ख) सर्गपद्धतिद्वारा शब्दनिर्माण (

पूर्वसर्ग (उपसर्ग) द्वारा शब्दनिर्माण:

अ, अन, कु, बे, बि, बद्

प्र, परा, अप, सम्, अनु, अब, वि, अघि, अति, उत्, प्रति, परि, उप, सु, निर्, दुस्, दुर् ।

परसर्ग (प्रत्यय) द्वारा शब्दनिर्माण (

निम्नलिखत कृत् प्रत्ययको ज्ञान र अभ्यास :

नु, ने, एको, तो, दो, एर, ई, न, आइ, ओट, आवट, अत, ओ, आउ, आहा, अक्कड, अन्त, उवा, इलो ।

अक, अन, इत, त, ता, ति, य, तव्य, अनीय ।

निम्नलिखित तद्धित प्रत्ययको ज्ञान र अभ्यास:

ली, आली, आलु, आहा, इया, इयार, इलो, औली, यौली, ए, एली, ले, आई, आइँ, याइँ, पन/पना ।

आलु, इक, इत, ई, ईय, ईन, ईण, क, तम, ता, त्व, मय, मान्, वान्, य ।

ग) समासद्वारा शब्दनिर्माण

समासको चिनारी, समास र विग्रहको प्रक्रिया एवं समस्तशब्दहरुको पहिचानको अभ्यास : समासका प्रमुख भेदहरु (तत्पुरुष, कर्मधारय, द्विगु, अव्ययीभाव, बहुब्रीहि र द्वन्द्व समासमात्र) र तिनका आधारमा समस्त शब्दहरुको निर्माण र विग्रह गर्ने एवं समासका नामको पहिचान गर्ने अभ्यास ।

घ) द्वित्वद्वारा शब्दनिर्माण : द्वित्व र अन्य व्युत्पादन प्रक्रियामा फरक, पूर्ण र आंशिक द्वित्व प्रक्रियाद्वारा शब्दनिर्माण गर्ने अभ्यास ।

ङ) सन्धि नियम :नेपानी तत्सम र तद्भव शब्दमा प्रयोग हुने प्रमुख सन्धि नियमको परिचय र अभ्यास ।

एकाई ५ : वाक्यतत्व : अंक १०, पाठ्यभार : १३

क) सरल वाक्यका उद्देश्य र विधेय तथा तिनको विस्तारको परिचयात्मक ज्ञान र अभ्यास ।

ख) क्रियाको परिचय :

अ) अकर्मक, सकर्मक, द्विकर्मक र पूराकापेक्षी तथा मुख्य र सहायक क्रियाको पहिचान ।

आ) प्रेरणार्थक क्रिया

इ) नामधातु

ई) सरल र संयुक्त क्रियामा फरक ।

ग) काल

अ) कालको परिचय

आ) भूत र अभूतकाल (वर्तमान र भविष्यत्)

घ) पक्ष:

अ) पक्षको परिचय

आ) काल र पक्षमा फरक

इ) पक्षका प्रकार सामान्य, पूर्ण, अपूर्ण, अभ्यस्त, अज्ञात, संभावना ।

ङ) भाव/अर्थ

अ) भाव वा अर्थको परिचय

आ) सामान्यार्थ, विध्यर्थ (आज्ञार्थ, इच्छार्थ), अनिश्चयार्थ (सम्भावनार्थ, संङ्केतार्थ) ।

च) बाच्य

अ) वाच्यको परिचय, वाक्यका भेद

आ) कर्तृवाच्य, कर्मवाच्य र भाववाच्यमा फरक

छ) संगति

अ) लिङ्ग, वचन, पुरुष, आदर आदिका आधारमा कर्ता र समापिका क्रियाबीच संगति

आ) विशेषण विशेष्य तथा भेदक भेद्यका बीचको संङ्गति

इ) नाम र सर्वनामका बीचको सङ्गति

ज) कारक र विभक्ति

अ) कारकको परिचय, कारक र विभक्तिको सम्बन्ध, कारकका भेद

आ) कर्ता, कर्म, करण, सम्प्रदान, अपादान र अधिकरणका साथै सम्बन्ध र पूरकको परिचय

इ) प्रत्यक्ष र अप्रत्यक्ष कर्ममा फरक

ई) सरल र तिर्यक् कारक तथा तत्सम्बन्धी बिभक्ति नियम

उ) ले, लाई, मा, को, बाट, देखि विभक्तिको प्रयोगसम्बन्धी नियम ।

झ) पदक्रम :

अ) पदक्रमको चिनारी

आ) विशेषण विशेष्यको पदक्रम (भेदक, विशेषण र नाम, क्रियायोगी र क्रियाका वीच)

इ) कर्ता र क्रिया: कर्ता, कर्म, (अप्रत्यक्ष र प्रत्यक्ष कर्म) र क्रिया, कर्ता कर्म र क्रियायोगिकको पदक्रम ।

ई) व्याकरणात्मक र साहित्यिक (आलंकारिक) पदक्रम

एकाइ ६ : वाक्यका प्रकार र वाक्यान्तरण : अंङ्क: १० पाठ्यभार: १२

वाक्यका प्रकार:

क) सरल, संयुक्त र मिश्र वाक्यको पहिचान र अभ्यास

ख) सरल सामान्य वाक्यको उद्देश्य र विधेय, तथा तिनको विस्तार चिन्ने अभ्यास ।

वाक्यान्तरण : सरल सामान्य वाक्यबाट विभिन्न अर्थकाका वाक्यमा परिर्वतन ।

ग) मिश्रवाक्यका मूख्य र आश्रित उपवाक्य चिन्ने अभ्यास ।

घ) सरल वाक्यबाट सरल, संयुक्त र मिश्र वाक्यमा वाक्यसंश्लेषण गर्ने अभ्यास ।

ङ) वाक्यसंश्लेषण गर्दा हुने संयोजक, सर्वनाम र असमापिका क्रियाको प्रयोग र विभिन्न पद र पदावलीको लोपको ज्ञान र अभ्यास ।

च) सरल वाक्यको नामीकरण, विशेषणीकरण र क्रियायोगीकरण ।

छ) प्रत्यक्ष कथन र अप्रत्यक्ष कथनका आधारमा उक्ति परिवर्तनको अभ्यास ।

खण्ड ख : प्रयोजनपरक, बोध, अभिव्यक्ति र कृतिसमीक्षा: अंक ५०, पाठ्यभार: ६०

एकाइ १: प्रयोजनपरक नेपाली : अंक: ५ पाठ्यभार: ५

क) भाषिक भेदको पहिचान

lnlvt / df}lvs e]bsf] klxrfg

cf}krfl/s / cgf}krfl/s e]bsf] klxrfg

ख) सामान्य र प्रयोजनपरक (प्रकार्यपरक) भेदको पहिचान

ग) कृषि, पशुपालन र पशुचिकित्सा एवं पशुस्वास्थ्य क्षेत्रमा प्रयुक्त नेपाली भाषाका विशेषताहरुको पहिचान । (बिषय, प्राविधिक शब्दावली, शब्दस्रोत, वाक्यगठन, शब्दनिर्माण, क्रिया, अभिव्यक्ति शैलीका सन्दर्भमा)

एकाई २: बोध र शब्दभण्डार तथा बुँदा टिपोट र संक्षेपीकरण अंक: १३ पाठ्यभार: ५

क) ज्ञान विज्ञान (वातावरण, जनसंख्या आदि) प्रविधि र विशेषगरी कृषि पशुपालन तथा पशुचिकित्सा एवं पशुस्वास्थ्य क्षेत्रका (दृष्टांश तथा अदृष्टांश) सामग्रीको बोध गर्नाका साथै त्यस्तै सामग्रीमा आधारित बोधात्मक र भाषिक प्रश्नहरुको मर्म बुझी छोटो छरितो उत्तर दिने अभ्यास ।

ख) शब्दभण्डार:

उपर्युक्त किसिमका सामग्रीमा रहेका शब्दभण्डारमध्ये विशेष महत्वपूर्ण वा कठिन शब्दहरुको निर्माण, शब्दनिर्माणसहित अर्थ र वाक्य प्रयोगसम्बन्धी अभ्यास ।

ग) बुदा टिपोट:

उपर्युक्त सामग्रीका मुख्य मुख्य बुँदा ठम्याई तिनलाई बुँदाका रुपमा टिप्ने अभ्यास:

घ) संक्षेपीकरण:

बिस्तृत र संक्षिप्त अभिव्यक्तिमा पाइने भिन्नता पहिचान र कुनै अभिव्यक्तिमा रहेका विषयवस्तुका मूलभूत कुरा ठम्याई छोटकरी ढङ्गले मितव्ययितापूर्ण भाषाशैलीमा मूल

अभिव्यक्तिको एकतृतियांशमा संक्षेपीकरण गर्ने अभ्यास: यस क्रममा बिशेष गरी कृषि र पशुचिकित्सा क्षेत्रका गद्यका दृष्टांश र अदृष्टांश सामग्रीबाट अभ्यास गर्ने ।

एकाइ २: अनुच्छेदलेखन र पत्ररचना :अंक ४, पाठ्यभार ५

क) अनुच्छेदलेखन:

विभिन्न शैलीमा लेखिएका अनुच्छेदहरुको पहिचान र विशेषगरी कृषि पशुपालन तथा पशुचिकित्सा एवं पशुस्वास्थ्य विषयमा केन्द्रित भई गद्य अनुच्छेदलेखन गर्ने अभ्यास ।

ख) पत्ररचना :

पत्रलेखनका विभिन्न ढाँचा एवं तरिकाको ज्ञान र अभ्यास: कार्यालयीय पत्र, निवेदन, सूचना, निमन्त्रणापत्र र विज्ञापनको रचनासम्बन्धी ज्ञान र लेखनको अभ्यास ।

एकाइ ३ : निबन्ध, टिप्पणी र प्रतिवेदन लेखन: अंक ८, पाठ्यभार १०

क) निबन्ध लेखन :

निबन्ध लेखनको सामान्य ढाँचा र तरिकाको ज्ञान एवं अभ्यास: विभिन्न समसामयिक विषय र शीर्षकमा केन्द्रित रही तत्सम्बन्धी विषयबस्तुलाई क्रमबद्ध र व्यवस्थित ढंगले विस्तृत रुपमा गद्यात्मक अभिव्यक्ति गर्दै वस्तुपरक, आत्मपरक, भावपरक र विचारपरक निबन्ध लेख्ने अभ्यास ।

ख) टिप्पणीलेखन :

कुनै समसामयीक वा विशेष महत्वपूर्ण समस्या वा विषयलाई लिएर केही अनुच्छेदको प्रयोग गरी मझौला (नछोटो नलामो) आकारको गद्यात्मक अभिव्यक्ति दिई टिप्पणी लेख्ने तरिकाको ज्ञान एवं अभ्यास ।

ग) प्रतिवेदन लेखन :

आफूले देखेसुनेको, भोगेको, अनुभव गरेको र अध्ययन गरेको कुनै सन्दर्भ (घटना, सभा, समारोह, चाडपर्व, यात्रा, समस्या वा अन्य) विषयका कुरा तत्सम्बन्धी आफ्ना अनुभव, बिचार आदिको समावेश गरी लेखिने गद्यात्मक लामो अभिव्यक्तिस्वरुप प्रतिवेदन (वर्णन, विवरण वा रिपोर्ताज) लेख्ने तरीकाको ज्ञान र अभ्यास ।

एकाइ ४: कृतिसमीक्षा: अंक २० पाठ्यभार २५

निम्नलिखित कृतिबारे समीक्षा लेख्ने अभ्यास :

कविता:

लेखनाथ पौड्याल	नैतिक दृष्टान्त
लक्ष्मीप्रसाद देवकोटा	वन
गोपालप्रसाद रिमाल	परिवर्तन
सिद्धिचरण श्रेष्ठ	माग्नेको गीत
माधवप्रसाद घिमिरे	यही हो मेरो मिथिला
भूपि शेरचन	मेरो देश

एकाङ्कीनाटक:

बालकृष्ण सम	रणदुल्लभ (एकाङ्की)
विजय मल्ल	बहुला काजीको सपना (नाटक)

कथा:

गुरुप्रसाद मैनाली	छिमेकी
विश्वेश्वरप्रसाद कोइराला	सिपाही
भवानी भिक्षु	हारजित
इन्द्रबहादुर राई	रातभरि हुरी चल्यो
रमेश विकल	मधुमालतीको कथा

निबन्ध:

लक्ष्मीप्रसाद देवकोटा	वीरहरु
श्यामप्रसाद शर्मा	आइमाई साथी
भैरव अर्याल	महापुरुषको संगत

उपन्यास:

लीलबहादुर क्षेत्री	बसाइँ

कृतिसमीक्षाका आधारहरु विधा र कृतिहरु निम्नलिखित अनुसार हुन्छन् : शीर्षक, विषयवस्तु, मूलभाव र विचार, कथानक, पात्र, परिवेश, छन्द, लय, दृश्यविधान, संवाद आदि ।

शिक्षणसम्बन्धी निर्देशन :

यो तहअर्न्तगत प्रथम बर्षको सय पूर्णाङ्कको एक पत्रका रुपमा रहेको यो अनिवार्य नेपाली पत्रको शिक्षण गर्दा शिक्षकहरुले निम्नलिखित कुराहरुमा विशेष ध्यान दिई विद्यार्थीहरुलाई सम्बन्धित शैक्षिक तहअनुरुप नेपाली भाषासम्बन्धी भाषिक सीपहरु प्राप्त गर्न सक्षम बनाउने ।

१. त्रुटिका क्षेत्र पहिल्याई निराकरणात्मक उपाय अँगाल्ने, यस काममा वर्णविन्यास र वाक्यगठनमा विशेष ध्यान दिने ।

२. विद्यार्थीहरुमा पठनशीलता बढाउनका निम्ति तोकिएको पाठ्यपुस्तकका अतिरिक्त रोचक र ज्ञानप्रद सामग्री, लेख(रचना, पुस्तक आदिको सूचि बनाई उत्प्रेरित गर्न

३. व्याकरणका विभिन्न पाठ्यवस्तुको शिक्षणका क्रममा संज्ञान पक्ष र त्यसको प्रयोगात्मक अभ्यासका बीचमा समन्वय स्थापित गर्ने र आगमनात्मक पद्धतिको समेत प्रयोग गर्ने । श्रव्य(दृश्य सामग्रीमा आधारित प्रदर्शनात्मक विधि र व्याख्यानात्मक विधिसंग कक्षा छलफल र प्रश्नोत्तर विधिलाई पनि उपयुक्त अनुपातमा प्रयोग गर्ने ।

४. प्रयोजनपरक नेपालीको शिक्षण गर्दा संज्ञानात्मक पक्षलाई कम मात्रामा प्रयोग गरी कृषि र पशुचिकित्सा एवं पशुस्वास्थ्य क्षेत्रका विषयमा नेपाली भाषाको प्रयोगका नमूना संकलनगरी कक्षाकार्यका रुपमा त्यसका विशिष्टताको पहिचानमा जोड दिने ।

५. बोध र अभिव्यक्तिसम्बन्धी पाठ्यवस्तुको शिक्षण गर्दा संज्ञानात्मक पक्षलाई न्यूनतम रुपमा प्रयोग गरी अभ्यास पक्षमा जोड दिने, विभिन्न अभिव्यक्तिको अभ्यासका क्रममा शुद्ध र स्तरीय मौलिक अभिव्यक्ति पक्षमा पनि ध्यान दिने ।

६. कृति समीक्षासम्बन्धी पाठ्यवस्तुको शिक्षणगर्दा लेखकसम्बन्धी नदिई नहुने अति संक्षिप्त चिनारीमात्र दिई मुख्य रुपमा कृतिपरक अध्ययन र निर्धारित विभिन्न कोणमा आधारित विवेचना गर्ने वस्तुगत कृतिसमीक्षा पद्धतिमा नै जोड दिई अभ्यास समेत गराउने ।

७. समय समयमा सम्बन्धित पाठ्यवस्तुको शिक्षणलाई प्रभावकारी पार्न मद्धत पुऱ्याउने गरी गोष्ठीविधि पुस्तकालयीय अध्ययनविधिको पनि प्रयोग गर्ने, साथै साहित्यिक र बौद्धिक अतिरिक्त क्रियाकलापका माध्यमलाई पनि प्रयोग गर्ने, यसै क्रममा पाठ्यविषयसंग सम्बन्धित तुल्याई विशिष्ट विद्वान, लेखक आदिको व्याख्यान, प्रवचन आदिको आयोजनालाई पनि सहायक शैक्षिक विधिका रुपमा प्रयोग गर्ने ।

८. समय समयमा सम्बन्धित पाठ्य विषयमा आधारित प्रश्न दिई गृहकार्य गराई सुधारात्मक टिप्पणी गरिदिने । वर्णविन्यास, शब्दनिर्माण, शब्दवर्ग (पदकोटि) आदिका पठनपाठनका क्रममा नेपाली शब्दकोशको प्रयोग गर्ने बानी बसाल्ने ।

एकाइ ५ : मूल्याङ्कन योजना :

अवधारणा :

यस तहको मूल्याङ्कन हाल प्रचलित मूल्याङ्कन पद्धतिअनुसार लिखित परीक्षाका माध्यमबाट गरिनेछ । शैक्षिक सस्थाहरुले आफ्ना हिसाबले शैक्षिक स्तर उठाउन आन्तरिक परीक्षालाई पनि मूल्याङ्कनको माध्यम बनाउनेछन् ।

प्रश्नहरु ज्ञानपरक मात्र नभई सीप र प्रयोगपरक पनि हुनेछन् । यस्तो मूल्याङ्कनद्वारा विद्यार्थीहरुको भाषिक प्रयोग व्याकरण, बोध र अभिव्यक्तिसम्बन्धी स्तरीयता एवं अभ्यासात्मक र सीपपरक क्षमतामा जोड दिइने छ ।

प्रयोग :

यसको मूल्याङ्कन प्रक्रियाको उपयोग तल प्रस्तुत गरेको प्रश्न योजनाअनुसार लामो उत्तरात्मक र संक्षिप्त उत्तरात्मक प्रश्नहरु सोधी औपचारिक परीक्षाका माध्यमबाट गरिनेछ ।

पुस्तक तथा सहायक पुस्तकहरु

१. लिलबहादुर क्षेत्री — **बसाईं**, साझा प्रकाशन ।

२. मोहनराज शर्मा — **शब्दरचना र बर्णविन्यास, वाक्यतत्व र अभिव्यक्ति** (नयां संस्करण, काठमाण्डौ बुक सेन्टर, काठमाण्डौ ।

३. कृष्णप्रसाद पराजुली — **नेपाली अध्ययन तथा अभिव्यक्ति,** रत्नपुतक भण्डार काठमाण्डौ ।

४. हेमनाथ पौडेल — **अनिवार्य नेपाली व्याकरण बोध र अभिव्यक्ति**, पैरवी प्रकाशन, काठमाण्डौ ।

५. मुरलीधर घिमिरे — **अनिवार्य नेपाली,** हजुरको पुस्तक संसार, काठमाण्डौ

गोरखापत्र (सत्रावधिका, सम्पादकीय, टिप्पणी लेखहरु), गोरखापत्र सस्थान काठमाण्डौ

Physics

Total hours: 190 **Full Marks: 100**

Theory 128

Practical: 64

Course description

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

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

Course objectives

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

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

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, *A text book of physics by Satya Prakash Part I & II*

Nelkon and parker, advanced level physics (5^{th} ed.)

Shrestha, U. P, Physics Practical Guide

Shrestha, V.K. Numerical examples in physics Vol. I and II Ratna Pustak Bhandar, Nepal.

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	**Hrs. Theory 128 Hrs. lab 64**
Unit 1: Mechanics	**Hrs. theory 30**
1.1 units and measurement	**Hrs. theory 3**
Objectives	**Content**
Measure precisely mass, length, time, volume, density, pressure and specific gravity. Define fundamental and derived units Explain MKS, CGS and SI system of units Convert one system of units into another system of units Express derived units in terms of fundamental 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 callipers, Micro Meter 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 Explain use of dimensional equation to test the correctness of physical equations to derive physical equations

	to convert one system of unit in to another system of unit. to find dimensions of a constant in an equation.
Evaluation methods: written and viva exams, performance observation.	Teaching/learning activities and resources: classroom instruction and demonstration return demonstration models, solving related problems.
1.2 scalar and vectors	**Hrs: theory 2**
Objectives	**Content**
Differentiate between vectors and scalars. Identify whether a physical quantity is scalar of vector. Resolve vectors into rectangular components. point out the resultant to two or more vectors by graphical method. write the values of scalar product and vector product, for selected problems	Scalar and vectors with examples Vectors addition by parallelogram and triangle method Resolve a vector into two components. The product of two vectors either results in a scalar quantity or a vector quantity Simple numerical problems
Evaluation methods: written and viva exams, performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
1.3 Kinematics	**Hrs: theory 4**
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	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

and horizontal tangs of projectile. Solve simple problems related to the projectile.	
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 8**
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. 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	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 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 3**

Objectives	**Content**
Fined work energy and power and give their units in various systems. Define KE and PE also give their magnitude. Relation between Watt and Horse power 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 with height and depth Differentiate between mass and weight State the condition of equilibrium of a body Differentiate between center of gravity and center of mass. Define weightlessness Define escape velocity	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. Formula of escape velocity (No derivation) 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 3**

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 rotary pump and lift pump 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=ρgh. Pascal's law. Density and specific gravity. Difference between density and specific gravity. Working principle of pumps 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.
1.8 Properties of matters	**Hrs theory 4**
Objectives	**Content**
Define elasticity State Hook's law of elasticity. Define stress, strain and Young's modulus of elasticity. Define viscosity. State Newton's formula of viscosity. Define coefficient of viscosity. Deduce unit and dimension of viscosity. Define terminal velocity. Define and explain surface tension. Explain Adhesive force and cohesive force.	Definition of elasticity Statement of Hook's law of elasticity. Definition of stress, strain and Young's modulus of elasticity. Definition of viscosity. Statement of Newton's formula of viscosity. Definition of coefficient of viscosity. Derivation of unit and dimension of viscosity. Definition of terminal velocity. Definition and explain surface tension. Definition of Adhesive force and cohesive force.

Explain phenomenon of capillarity (no derivation of formula). Solve related numerical problems.	Solve related numerical problems.
Evaluation methods written and viva exams, performance observation.	Teaching/learning activities and resources: classroom instruction and demonstration return demonstration models, solving related problems.
Unit 2: Heat	**Hrs theory 20**
2.1 Thermometry	**Hrs theory 2**
Objectives	**Content**
Define heat and temperature and distinguish between them. Describe the 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 sensitivity of a liquid thermometer. Demonstrate various types of thermometers and explain their uses. Derivation of the formula: C/5 = (F-32)/9=(K-273)/5 Relation between different temperature scales. Simple numerical problems
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 Thermal Expansion	**Hrs theory 3**
Objectives	**Content**
Describe linear, superficial and cubical expansion of solids and their expansivity. State the relation between linear, superficial and cubical expansivity of solids (not derivation).	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 $\beta=2 \alpha$.

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).	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 3**
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 boiling point of the substance.	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.
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: Hygrometry	**Hrs theory 3**
Objectives	**Contents**
Explain saturated and unsaturated vapor. Define triple point. Define dew point, absolute humidity and relativity humidity. Explain dryness and dampness. Determine relative humidity by wet and dry bulb hygrometer. Explain Air conditioning. Solve related numerical problems.	Definition of saturated and unsaturated vapors. Definition of triple point. Definition of dew point, absolute humidity and relativity humidity. Explanation of dryness and dampness. Determination of relative humidity by wet and dry bulb hygrometer. Description of Air conditioning. Solve related numerical problems.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
2.5: Transfer of heat	**Hrs theory 3**
Objectives	**Contents**
Differentiate between conduction, convection and radiation. Define thermal conductivity with its units. and dimension. Distinguish between good and bad conductors of heat. Define black body with examples. State the Stefan Boltzmann's law and give. an example of its application. Solve related numerical problems.	The transfer of heat by conduction, convection and radiation Thermal conductivity giving its dimension and units Laws of black body radiation Solve related numerical problems.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems

2.6: Gases	**Hrs theory 6**
Objectives	**Contents**
State Boyle's law and Charle's law Define absolute temperature and absolute Zero. State ideal gas equation. Know the value of R. State and explain Dalton's law of partial pressure. Derive general formula of work done by gas. Define internal energy of gas. State first law of thermodynamics. Define Molar and specific heat capacity of gas. Derive C_p-C_v= R Explain Isothermal and adiabatic changes. Derive expression for pressure exerted by gas. Find expression for *r.m.s*. speed. Solve related numerical problems.	Statement of Boyle's law and Charle's law Definition of absolute temperature and absolute Zero. Concept of ideal gas equation. Know the value of R. To state and explain Dalton's law of partial pressure. Derivation general formula of work done by gas. Definition of internal energy of gas. Statement of first law of thermodynamics. Definition of Molar and specific heat capacity of a gas. Derivation of C_p-C_v= R Definition of isothermal and adiabatic changes. Derivation of pressure exerted by a gas. Explanation for *r.m.s.* speed. Solve related numerical problems.
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 20**
3.1 Reflection of light	**Hrs theory** 4
Objectives	**Content**
Explain the laws of reflection of light. Find the deviation of light by plane mirrors as	The Phenomenon of reflection and hence state the laws of reflection of light

rotating mirror. Distinguish between real and virtual image. Show that in a 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	Regular and irregular reflection of light The rotation of light by plane mirror. Object distance is just equal to image distance i. e.u=v but the image is virtual Real and virtual image. Image formation by spherical mirrors. Sign convention for the focal length, object distance and image distance. The relation R=2f, 1/u+1/v=1/f and Manification (m) = I/O= v/u for mirrors. Nature, size and position of the image formed by spherical mirrors at various positions of the object distance on the principal axis. Simple numerical problems
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
3.2: Refraction	**Hrs theory 7**
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 angle and total internal reflection. Explain the phenomena of total internal reflection. Explain the passage of light rays through a	Phenomenon of refraction. Refractive index in terms of the speed of light in vacuum to the speed of light in medium. The relations ${}_a\mu^g \times {}_g\mu^a=1$. Refractive index in terms of real depth and apparent depth. The relation d=t (1-1/μ) and lateral shift P=t[sin(i-r)]/cosr. Derivation of the formula μ=1/Sinc. Critical angle and conditions for total internal

prism. Derive the formula i+e=A+δ and A=r_1+r_2. Define minimum deviation and derive the formula μ=sin(A+ δ_m)/2/sin(A/2). Draw a ray diagram to locate positions of image in thin lenses (concave and convex). Lens formula and lens maker's formula (No derivation).	reflection. Examples of total internal reflection phenomena like mirage, light pipe. The formula A+ δ_m =i+e and μ= sin (A+ δ_m/2/sinA/2. Uses of different types lens. Converging aspect of convex lens and diverging aspect of concave lens. Lens formula and lens maker's formula(No derivation). Simple numerical problem
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
3.3: Optical Instrument	**Hrs theory 6**
Objectives	**Contents**
Explain defects of vision- Myopia and Hypermetropia. Define angular magnification of telescope. Define astronomical telescope in normal adjustment. Simple microscope- Ray diagram and formula for magnification. Compound microscope – Ray diagram and formula for magnification. Define dispersion of light. Define luminous flux, luminous intensity and illuminance, lumen, lux and candela. State inverse square law of photometry.	Explain defects of vision- Myopia and Hypermetropia. Definition of angular magnification of telescope. Definition of astronomical telescope in normal adjustment. Simple microscope- Ray diagram and formula for magnification. Compound microscope – Ray diagram and formula for magnification. Explanation of dispersion of light. Definition of luminous flux, luminous intensity and illuminance, lumen, lux and candela. Statement of inverse square law of photometry.

Solve related numerical problem.	Solve related 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
3.4: Wave theory of light	**Hrs theory 3**
Objectives	**Contents**
Explain wave front and wavelets. State Huygen's principle. Define coherent sources. Define interference, constructive interference and destructive interference. Define diffraction of light. Show formation of interference and diffraction fringes by diagram. Define Polarisation of light.	Explanation of wave front and wavelets. Statement of Huygen's principle. Definition of coherent sources and interference Definition of constructive and destructive interference Definition of diffraction of light. Show formation of interference and diffraction fringes by diagram. Explanation of Polarisation of light.
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 6**
4.1: Electrostatics field	**Hrs theory 6**
Objectives	**Contents**
Concept of electric charge. State modern theory of electrification. 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	Concept of electric charge. Statement of modern theory of electrification. Coulomb's law for point charges and derivation of the expression for force Effects of permittivity on a medium between two point charges Electric field and normal electric flux.

Define electric potential difference, potential energy and electron volt. Explain the equipotent surface Explain the zero potential. Define capacitor, its types and uses. Define capacitance. Derive E=V/d, for parallel plates capacitor	Potential and potential energy Analogy between electric potential and gravitational potential. Electron volt and its use Use of capacitor and its types Definition of capacitance
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. Wave	**Hrs theory 4**
5.1: Wave motion	**Hrs theory 4**
Objectives	**Contents**
Define damped vibration, forced vibration and resonance. Define longitudinal wave, progressive wave and stationary wave. State progressive wave equation and stationary wave equation. Explain velocity of sound in medium and gas by Newton's formula & Laplace formula (no derivation). Effect of temperature, pressure & humidity on velocity of sound. Define harmonics and overtones. Concept of fundamental frequency and harmonics in organ pipes. State laws of transverse vibration of string. Solve related numerical problems	Definition of damped vibration, forced vibration and resonance. Definition of longitudinal wave, progressive wave and stationary wave. State progressive wave equation and stationary wave equation. Explanation of velocity of sound in medium and gas by Newton's formula & Laplace formula (no derivation). Effect of temperature, pressure & humidity on velocity of sound. Definition of harmonics and overtones. Concept of fundamental frequency and harmonics in organ pipes. Statement of laws of transverse vibration of string.

	Solve related numerical problems
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
Unit 6: Magnetism	**Hrs theory 10**
6.1: Fundamentals of Magnetism	**Hrs theory 10**
Objectives	**Contents**
Explain magnetic field strength, lines of force, magnetic field intensity and permeability State coulomb's law for magnetism Describe the properties of a magnet Calculate magnetic field intensity due to a bar magnet at any pointy on the equatorial and axial line of a bar magnet. Trace the lines of force and describe their properties. Define natural point. Describe the dip, declination and horizontal components of earth's magnetic field. Define and give the properties of dia, para and ferromagnetic materials	Like pole repel and unlike pole attract each other Various types of magnets and their positions of poles Coulomb's law for magnetism Magnetic field intensity due to bar magnet at End on position Board side on position Lines of force around a bar magnet and the natural point. Uniform and non uniform magnetic field Dip, declination, horizontal and vertical components of earth's magnetic field. Properties of dia, para and ferromagnetic materials
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
Unit 7: Current electricity	**Hrs theory 16**
7.1: Electric current	**Hrs theory 4**
Objectives	**Contents**
Discuss current as the rate of flow of charge.	Current as the rate of flow charge

State and verify Ohm's law. Define resistance and resistivity 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	Potential deference Ohm's law and its verification Expression $R=R_1+R_2+R_3+$.....and $1/R=1/R_1+1/R_2+1/R_3+$..... in series and parallel combination. Conversion of a galvanometer into ammeter and voltmeter. Ohmic and non-Ohmic conductors from I-V curve. Conversion of galvanometer into voltmeter and ammeter. Simple numerical problems.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
7.2: Resistance and heat	**Hrs theory 4**
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
7.3: Electromagnetism	**Hrs theory 4**
Objectives	**Contents**
Explain Oersted's discovery, direction of current and field. Dependence of force on physical factors. Find force on moving charge. State the principle of moving coil galvanometer. Define electromagnetic induction.. State Faraday's laws of electromagnetic induction. State Lenz's law. State principle and working of a.c. generator. Solve related numerical problems.	Explanation of Oersted's discovery, direction of current and field. Dependence of force on physical factors. Find force on moving charge. Statement of principle of moving coil galvanometer. Definition of electromagnetic induction.. Statement of Faraday's laws of electromagnetic induction. Statement of Lenz's law. Principle and working of a.c. generator. Solve related numerical problems.
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: Alternating current	**Hrs theory 4**
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 principle and working of a transformer and its losses.	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

Describe step up and step down transformers. State faraday's laws 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 8: Modern physics	**Hrs theory 22**
8.1: Electrons	**Hrs theory 4**
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
8.2: Photo electricity	**Hrs theory 4**
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 State postulates of Bohr's theory of hydrogen atom.	Photoelectric effect, quantum theory of radiation. Einstein's photoelectric equation $hv=\phi+1/2mv^2$ and interpretation. Simple problems using photoelectric equations. Explanation of postulates of Bohr's theory of hydrogen atom.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return

	demonstration models, solving related problems
8.3 X-ray	**Hrs theory 2**
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 and nature of x-rays. Properties of x-rays. Various uses of x-rays.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
8.4: Radioactivity	**Hrs theory 4**
Objectives	**Contents**
Explain the difference between natural and artificial radioactivity List the main properties of α, β and γ radiation. Explain why these forms of radiation have energy on the order of mega electron voltage. Write down the equation for the laws of radioactivity Write down the formula that shows that the relationship n between half-life and decay constant. Graph the decay of radioactivity with time. Explain the principle involved in radio carbon dating.	Radioactivity. Properties of α, β and γ radiations. Laws of radioactive disintegration. The constant relationship between half-life and decay. Medical uses of radiation and artificial radioactive nuclei. $N=N_o e^{-\lambda t}$, $dN/dt = -\lambda t$ Simple numerical problems.
Evaluation methods: written and viva exams performance observation	**Teaching/learning activities and resources:** classroom instruction and demonstration, return demonstration models, solving related problems
8.5: Properties of nucleus	**Hrs theory 4**

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 $E=mc^2$ (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.
8.6: Physics and society	**Hrs theory 4**
Objectives	**Contents**
Describe how our environment is being destroyed due to noise pollution, air pollution, soil pollution, thermal pollution, radiation 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 and national levels.	Deteriorating conditions of the environment we live in. Useful and harmful aspects of radiation. Concepts about ozone depletion, greenhouse effect and acid rain. Concepts of different types of pollution. Environmental protection strategies.
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 Practical		**Hrs lab 64**
Objectives	**Contents**	
Determine the volume of a hollow cylinder and a solid cylinder using vernier calipers.	Volume of hollow and cylinder using vernier calipers	4
Determine the volume of a steel ball using a screw gauge	Volume of steel ball using screw gauge	2
Determine the area of a glass rod using a screw gauge.	Area of glass rod	2
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	6
Verify Archimedes's principle	Verification of Archimedes's principle	4
Determine the specific gravity of solids heavier than and insoluble in water.	Specific gravity of solids heavier than and insoluble in water.	4
Determine the specific gravity and density of substances lighter than water.	Specific gravity and density of substances lighter than water	4
Verify laws of refraction and find the refractive index of glass slab	Laws of refraction and Refractive index	4
Find the focal length of a convex lens by the double pin method.	Focal length of a convex lens	2
Verify the laws of moments of	Laws of moments of forces	4

forces and find the weight of a given body.	Weight of a given body	
Determine the latent heat of fusion of ice.	Latent heat of fusion of ice	4
Determine the magnetic moment and pole- strength of a bar magnet by locating the neutral points, keeping N-pole pointing south and N-pole pointing north.	Magnetic moment and pole-strength of a bar magnet by locating the neutral points	6
Verity Ohm's law by using an ammeter and voltmeter.	Ohm's law	6
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	4
Determine the refractive index of a prism using the 1-D curve method.	Refractive index of prism	2
Determine the resistance of given wire by meter-bridge.	Resistance of given wire by meter-bridge.	6
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.	

Mathematics

Creadit hours: 6 hrs/week **Full Marks: 100**

Total hours: 160

Course Description

This course in mathematic is designed to provide student to use mathematics skills necessary for application in agriculture. The course emphasizes both quantitative and qualitative aspects of Mathematics, involving mathematical derivation and concepts.

Course Objectives

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

- Apply mathematical skills to solve problems related to agriculture.
- 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.

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

Course: Mathematics	**Hrs. theory 160**
Unit1: Mathematics	**Hrs theory**
1.1: Revision on Algebra	**Hrs. theory 16**
Objectives	Contents
Define Sequence and series (arithmetic , geometrics , harmonic) Recall the formulae of A.P., G.P. and H.P. Define ratio and proportion and their	Formulae of A.P., G.P and H.P. Ratio and proportion and their properties. Formula of AM,GM and HM. Relation between AM,GM and HM.

properties. Sum of infinite geometric series. Define Means.	
1.2: Set theory and real number system	**Hrs. theory 18**
Objectives	Contents
Define and denote sets. Types of 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 with 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 solve related problems ,written examination,oral tests .	**Teaching / learning activities and resources:** charts, models, graph boards, diagrams, classroom instruction, teachers led discussion, demonstration of solutions illustration through practical examples, text and reference books.
1.3: Function and graph	**Hrs. theory 10**
Objectives	Contents

Define a function Classify function Identify the different functions. Sketch a graph of the various functions. Sketch a graph of trigonometric functions.	Functions and their inverse and related problems. Function defined as mapping. Composite functions and related problems. Algebraic, trigonometric, exponential and logarithmic function. Try only exercises II (1), (2), and (3) form the textbook of grade XI
Evaluation methods: written assignments to solve related problems, written examination, oral tests.	**Teaching/Learning activities and resources:** Charts, models, graph boards, diagrams, classroom instruction, teacher led discussion, demonstration of solutions, illustration through practical examples,text and reference books.
1.5: Quadratic equation	**Hrs.theory 15**
Objectives:	Contents
Define quadratic equation. Find the roots of a quadratic equation. Prove that quadratic equation can not have more than two roots. Find the nature of roots. Find the relation between roots and its co efficients. Formation of a quadratic equation. Find the condition that two quadratic equations have one root common or two roots common.	Defination of quadratic equation. Finding of the roots of a quadratic equation. Proving that quadratic equation can not have more than two roots. Nature of roots. Relation between roots and its co efficients. Formation of a quadratic equation. Find the condition that two quadratic equations have one root common or two roots common.
Evaluation methods: written assignments to solve related problems, written examination, oral tests.	**Teaching/Learning activities and resources:** Charts, models, graph boards, diagrams, classroom instruction, teacher led discussion, demonstration of solutions, illustration through practical examples, text

	and reference books.
1.6: Matrices and determinants	**Hrs.theory 15**
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 terms minors and cofactors. Sarrus rule and expanding rule. Define the transpose and adjoint of a matrix. Define the inverse of a matrix.	Definition of matrix, notation, order, types of matrices and simple algebra of matrices. Construction of matrix. Condition of addition, substraction and multiplication of matrices. Adjoint,transpose, inverse 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, text and reference books.
1.7: Coordinate Geometry (Equation of a pair of lines)	**Hrs. theory 20**
Objectives	Contents
Equation of straight line in three standard forms. Find the equation of straight line in from one point and slope are given (point slope form.) Find the equation of straight line from two given points.	Equation of straight line in three standard forms. Find the equation of straight line in from one point and slope are given (point slope form.) Find the equation of straight line from two

Find the angle between two straight lines and condition of perpendicularity and parallelism. Find the length of perpendicular to straight line from a given point. 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 find the separate equations. Prove that the equation ($ax^2+2hxy+by^2=0$) always represents a pair of lines passing through the origin. Find the angle between two straight lines represented by the homogeneous equations of second degree ($ax^2+2hxy+by^2=0$)	given points. Find the angle between two straight lines and condition of perpendicularity and parallelism. Find the length of perpendicular to straight line from a given point. Line pair equation, two equations of straight lines as a single equation. Condition required for equation of Second degree ($ax^2+2hxy+by^2+2gx+2fy+c=0$) to represent a pair of lines and also find 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
1.8: limits and Values	**Hrs. theory 15**
Objectives	Contents
Define the term Limit and limiting values. Define indeterminant forms. Evalute the limiting values of simple algebraic & trigonometric Function. Use the formula Lt $\frac{X^n - a^n}{}$	Limit and limiting values. Limiting values of simple algebraic & trigonometric Function. Using the formula Lt $\frac{X^n - a^n}{}$ $x \rightarrow a$ X-a

$x \to a$ X-a Lt $\frac{\sin\theta}{\theta}$ =1 (Without Proof) $x \to \theta$ θ Define continuity and discontinuity of a function. Identify the continous and discontinuous of a function	Lt $\frac{\sin\theta}{\theta}$ =1 (Without Proof) $x \to \theta$ θ Define continuity and discontinuity of a function. Identify continous and discontinuous of a 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, text and reference books.
1.9 Derivatives and their applications **(Maxima and Minima)**	**Hrs theory 20**
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, $\sin^2 x$, $\cos^2 x$, $\sqrt{sinax}$. Use the sum, difference, product, quotient and chain rule of derivatives to calculate the derivatives of algebric function only. Derivatives of parametric and implicit functions. Apply the 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, $\sin^2 x$, $\cos^2 x$, $\sqrt{sinax}$. Using the sum, difference, product, quotient and chain rule of derivatives to calculate the derivatives of algebric function only. Derivatives of parametric and implicit functions. 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.
1.10: Integration	**Hrs. theory 16**
Objectives	Contents
Define integration(Antiderivative). Apply techniques of integration as anti derivate, substitution method, trigonometric substitution, integration by parts and definite integral. Use definite integral to calculate area enclosed by algebric curve, X-axis and ordinate at x=a to x=b.	Definition of integral as antiderivative, Application of techniques of integration as anti derivate, substitution method, trigonometric substitution, integration by parts and definite integral. Using definite integral to calculate area enclosed by algebric curve, X-axis and ordinate at x=a to x=b.
Evaluation methods: written assignments to solve related problems, written examination	**Teaching /learning activities and resources:** Charts, models, graph boards, diagram classroom instruction, teacher led discussion, demonstration of solutions, illustration through practical examples.
1.11: Trigonometry	**Hrs Theory 15**
Objectives	Contents
Find the general values of trigonometric equations. Use practical applications of trigonometry. Solve the problems related to inverse circular functions. Define sine law, cosine law, tangent law, projection law and half angle law. Find the solution of triangle	Trigonometrical equations and general values. Height and distance examples no.1 to 20 from textbook of intermediate trigonometry. Inverse circular functions. Prove sine law, cosine law tangent law, projection law and half angle law. (Related problem Exercise from the book of grade

	11). Area and solution of traingle.
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.

Chemistry

Credit hours: 4+1 hrs/week **Full Marks: 100**

Total hours: 192

Theory : 128

Practical: 64

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

Course Objectives

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

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

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 128** **Hrs. lab 64**
Unit 1: Physical Chemistry	**Hrs. theory 47**
Elements, compounds and chemical change	**Hrs. theory 3**
Objectives	Contents
1. List the symbols of elements. 2. Identify monovalent, divalent, trivalent elements and radicals. 3. List the information conveyed by symbol and formula 4. Identify physical and chemical change. 5. Identify the suitable process for separating constituents of a mixture. Q. What are the differences among H^+, H^-, H_2, $2H_2$, and 2H? Q. Write the molecular formula of potassium Ferro cyanide sodium peroxide.	Symbols for the atom, molecule, and compound radical and variable valency Writing, a chemical formula Significance of symbols and formulas Molecular and empirical formulas Difference between chemical compound from mechanical mixture Pure and impure substances
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?	Chemical equation, reactant and product Significance and limitations of chemical equations Ways of making chemical equations more informative Type of chemical reactions (seven-types) with examples 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 4**
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. 4. State Mendeleef's periodic law Q. which one, Cl or Br, is more electronegative and why?	Modern periodic classification of elements. Location of s, p, d, f-block elements Periodicity in properties by: Q. Atomic radii (ii) Electro negativity (iii) Ionization potential (iv) Electron affinity Definition of Mendeleef's periodic law, advantage and anomalies of periodic table and modern periodic law.
Evaluation methods: written exam, oral	**Teaching/Learning activities and resources:**

and written assignments, performance observation in lab	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 3**
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?	Effect of pressure and temperature on volume of gas Boyle's law, Charles'slam combined gas lawa, daltion law of partial pressure Simple derivation of ideal gas equation (PV=nRT) Diffusion of gas NTP or STP Kinetic theory of gases Related simple problems.
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 Q. Why water can flow more easily than honey?	Unsaturated, saturated and supersaturated solution Solubility, Solubility charge and related numerical problems

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.	The deference between amorphous and crystalline solids Water of crystallization, deliquescent, hygroscopic, efflorescent, Isomorphism 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.	Charge and mass of fundamental particles of atoms Rutherfords and Bohr's atomic model Shell, sub-shell and orbital (s, p, d, f) How atoms are arrangement of electrons in orbits (Aufbau principle) Atomic number, mass number, atomic weight and gram atomic weight 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 3**
Objectives	Contents
1. Define valence electron, duplet, octet and noble gas electronic configuration. 2. Describe the Lewis structure of different molecules. 3. List the properties of electrovalent, covalent and co-ordinate covalent bond. Q. Why is ammonia readily soluble in water?	Valence electron, duplet, octet and Noble gas electronic configuration The mode of formation and properties of compounds Electrovalent Covalent Co-ordinate covalent Polar and non-polar covalent bond and compound Types and effect of Hydrogen bond
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 2**
Objectives	Contents
1. Identify oxidation half, reduction half, oxidant and reductant.	Classical and electronic concept of oxidation and reduction. Oxidant and reductant and oxidation number Importance of oxidant, reductant in Biological process, sterilization and disinfection, bleaching and spot removal. Examples of redox reaction Balancing a redox reaction by i) oxidation number method ii) Ion-electron method
Evaluation methods: written exam, oral and written assignments, performance	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation,

observation in lab	problem solving, and demonstration.
1.10: Electrochemistry	**Hrs. theory 5**
Objectives	Contents
1. Differentiate between (i) Electrolytes and non-electrolytes (ii) Strong electrolytes and weak electrolytes (iii) Ions and atoms. 2. Describe the variation of degree of ionization 3. State and explain common ion effects 4. State briefly Faraday's laws of electrolysis 5. Compute the pH of neutral water above and below 25^{o}C 6. Define buffer solution (acidic and basic) 7. Solve numerical problems related with pH acidic or basic solutions Q. Explain why NaCl becomes ionized in water while glucose does not	Electrolytes, Non-electrolytes, strong and weak electrolytes Arrhenius theory of ionization Degree of ionization, Faraday's laws of electrolysis Electrolysis of water Ionic product of water, pH. pOH Buffer solution and mechanism of buffer action Importance of pH and buffer in human body
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.	Characteristics of acid and base. How acid neutralizes carbonate and neutralization of carbonate or bicarbonate by acid Theories of acids and base i) Arrlenilus theory ii) Bronsted-lowery theory iii) Leuis's Theory

	Various types of salts Nature of aqueous solution of salts. Antacids and antabases and their medical uses Examples of acid and base in plants and their roles
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration-reaction between: carbonate and acid, acid and base
1.12: Solutions-True solution	**Hrs. theory 3**
Objectives	Contents
1. Define osmosis, reverse osmosis, osmotic pressure, and isotonic, hypotonic and hypertonic solutions. 2. Explain the importance of osmosis ephemeron.	Dilute and concentrated solution Diffusion of solute in solution, osmosis, osmotic pressure isotonic, hypotonic and hypertonic solution 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	Mole and Avogadros' number. Determination of percentage composition. Numerical related to the following relationships based upon chemical equation - Mass-Mass relationship Mass-volume relationship

required to oxidize 10-gram glucose and volume of CO_2 will be formed?	Volume-volume relationship Calculation based on limiting reagent.
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
1.14: Volumetric analysis	**Hrs. theory 4**
Objectives	Contents
1. Define different units of concentration and show their relation. 2. Prepare standard solution of desired concentration and solve problems on dilution. 3. Solve different numerical regarding acidimetry and alkalimery.	Equivalent and gram equivalent weight of element, acid, base, and salt Titration, acidimetry, alkalimetry, end point, indictor, primary standard substance Ways of expressing concentration of solution in terms of i) Normality ii) Molarity iii) Molality and %. Normality equations Calculations to prepare different concentrations of solution
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 35**
2.1: An introduction to organic Chemistry	**Hrs. theory 3**
Objectives	Contents
1. List the difference between organic and inorganic compounds. 2. List the importance of organic	1. Origin of organic chemistry-Vital force theory and modern theory 2. Difference between organic and inorganic

compounds in medicines and drugs with common examples. 3. Role of forest product in medicine. 4. Scope of organic chemistry for Agriculture	compound 3. Sources of organic compound 4. Importance of organic compound in Agriculture (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 4**
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	Reason for large number of organic compounds- Tetrvalency Catenation property Isomerism Various types of organic compounds with their examples Functional group and its various types Homologous series with examples Prefix, primary suffix, secondary suffix, and principal functional group Naming aliphatic and aromatic compounds with IUPAC systems. Detection of foreign elements N,S and X
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.	Definition of isomerism. Structural isomerism of the types- (i) Positional (ii) Functional (iii) Metamerism (iv) Chain isomerism
Evaluation methods: written exam, oral and written assignments, performance observation in lab	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation, problem solving, and demonstration
2.4: Organic reaction	**Hrs. theory 4**
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.	Carbocation and carbanion. Inductive effect (+1 and -1 effect) Homolysis and heterolysis bond fission. Electrophones and Nucleophiles. Resonance. 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 4**
Objectives	Contents
1. Describe the isomerism in alkane. 2. Describe the substitution in alkenes. 3. Describe the knocking of fuel.	The physical properties of alkanes (only methane) Chemical properties-halogenation combustion, phyrolysis

	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.	Laboratory preparation of ethane from ethanol The physical properties. The chemical properties-Combustion, halogenation, with Br_2 solution, with halogen acid (Test of double bond), with Baeyer's reagent, polymerization, ozonolysis Markovnikov's rule
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
Objectives	Contents
1. Describe the addition reaction in alkyne. 2. Explain the acidic nature of alkyne. 3. Describe the test of alkyne	Laboratory preparation of ethyne from calcium carbide Physical properties of acetylene Chemical properties-Combustion, hylogenation, catalytic hydration, with Br_2 solution, with Na, with tollens reagent, with Bayer's; reagent, ozonlysis polymerization, with Cl_2 Markovnikov's rule. Uses of ethyne in life
Evaluation methods: written exam, oral and written assignments, performance	**Teaching/Learning activities and resources:** classroom instruction, theoretical explanation,

observation in lab	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.	Classification of alcohol as- monohydric, dihydric, polyhydric, primary, secondary and tertiary Identification of primary, secondary and tertiary alcohol by oxidation method Physical properties of ethanol Chemical properties- Oxidation, with sodium, with oxygen, with H_2SO_4, CH_3COCl, CH_3COOH, combustion
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 3**
Lesson: A Formaldehyde & Acetaldehyde	Hrs. theory 2
Objectives	Contents
1. Describe the physical and chemical properties of formaldehyde. 2. List uses of formaldehyde.	General methods of preparation Physical properties. Chemical properties-with ammonia, with NH_4OH, NaOH, Polymerisation.

	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. 3. List the uses of ketonic compounds.	Preparation from isopropyl alcohol and Ca-acetate Physical properties Chemical properties with $NaHSO_3$, Phenyl hydrazine Uses in everyday life
2.9: Carboxylic acid Acetic Acid	**Hrs theory 2**
Objectives	Contents
1. Identify the homologue of aliphatic nomocarbocyhlic acid. 2. Describe the physical properties of acids (solubilty, acidic character). 3. Describe the uses of vinegar. Q. Write down the uses of acetic acid.	Preparation from acetylene and ethanol Physical properties Chemical properties with-$NaHSO_3$, NH_3, C_2H_5OH, PCl_5 and reduction, acidity of carboxylic acid Uses in everyday life Uses of formic acid in everyday life Natural sources of acetic acid
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	Nomenclature and classification of amines

their names.	Basicity of amines 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: Phenol	**Hrs. theory 3**
Objectives	Contents
1. Prepare phenol from benzene diazonium chloride and sodium benzene sulphonate. Explain action with Na, Zn, NH_3, benzenediazonium chloride kolbe's reaction.	Preparation from benzene diazonium chloride and sodium benzene sulphonate, physical properties. Action with Na, Zn, NH_3, benzenediazonium chloride kolbe's reaction.
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.
2.12: Natural Products chemistry	**Hrs. theory 3**
Objectives	Contents
1. make a list of medicinal plants. 2. Introduction of phytochemical techniques 3. define alkalides, steroids, and antibiotics.	List of Medicinal Plants in Nepal Phytochemical Technique; Extraction, Isolation, Purification, and charaterisation of Natural products Introduction about alkaloids, steroids, antibiotics
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 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	Lab preparation of diethylether from ethanol Physical properties Chemical Properties with Combustion, hydrolysis, reaction with HI and PCl_5 Uses in medicine and everyday life
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.	Aromatic compounds Nomenclature of benzene derivatives (Mono, di and tri-substituted) To define heterocyclic compounds. Characteristics of aromatic compounds Differences between aliplatic and aromaticlomped Nomenclature and examples of different aromatic compounds
3.3 : Food Chemistry.	**Hrs. Theory 1**
Objectives.	Contents.
To make lists of hygienic foodstuffs.	Definition and advantage of Food Chemistry.
Evaluation methods: written exam, oral	**Teaching/Learning activities and resources:**

and written assignments, performance observation in lab	classroom instruction, theoretical explanation, problem solving, and demonstration.
Lesson: B. Benzene	Hrs. Theory 1
1. Describe the preparation, properties and uses of Benzene	prepare atiob of benzene Kekule structure of benzene Physical properties of benzene Chemical Properties- Halogenations, nitration, sulphonation, Friedal craft's reaction, Combustion and hydrogenation 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,	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

ozone layer depletion and green house effect	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 30**
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 4. Define degree of hardness of water 5. Define heavy water	Soft and hard water The process of removal of hardness: -Boiling, Clark's process using washing soda, permutit process, soda-ash method, deionization of water The advantages and disadvantages of hard water The meaning of drinking water Methods of purification of drinking water by boiling, candle filtration, chemical disinfection, bleaching powder, Cl_2 solution, iodine, $KMnO_4$ ozonisation, using potash alum The solvent property of water
Evaluation methods: written tests, written	**Teaching/Learning activities and resources:**

assignments, performance observation	classroom instruction, problem solving exercises, demonstrations
5.2.: Metals	**Hrs. theory 6**
Objectives	Contents
1. Distinct between metals and non-metals 2. Describe ores and materials, occurrence of metals. 3. Describe general metallurgy of metals. (crushing and dressing) 4. Describe Calcinations and roasting, reduction with carbon. 5. Describe purification (distillation and electro refining) 6. Describe about sodium 7. Describe about physical properties of copper 8. Describe about Zinc **9.** Describe about Iron	Characteristic of metals and non-metals Occurrence of metals. General metallurgy of metals. (crushing and dressing) Calcination and roasting, reduction with carbon. Purification (distillation and electro refining) Sodium: physical properties, action with air, water, non-metals NH_3. Physical properties of copper, action with H_2SO_4, HNO_3, and short notes on bluevitrol. Zinc, physical properties, action with HCl, HNO_3, H_2SO_4, water, air and alkali, galvanization. Iron : physical properties action with HCl, HNO_3 , H_2SO_4, water, halogen, rusting.
Evaluation methods: written tests, written assignments, performance observation	**Teaching/Learning activities and resources:** classroom instruction, problem solving exercises, demonstrations
5.3.: **Acids and fertilizers**	**Hrs. theory** 6
Objectives	Contents
1. Define and formation of Nitric Acid: 2. Describe Nitrogen cycle and causes of acid rain 3. Describe NPK fertilizer. 4. Explain pesticide 5. Explain Sulphuric acid 6. Explain Hydrochloric acid	Nitric Acid: Ostwald process. (principle with diagrammatic sketch.) Physical properties, acidic character, action with carbon, sulphur, H_2S, SO_2. Action with $FeSO_4$, Mg, Zn, copper, ring test. Nitrogen cycle and causes of acid rain NPK fertilizer, characteristics, natural and artificial fertilizer, examples and need of NPK fertilizers. Pesticide insecticide, rodenticide herbicide,

	fungicide and their examples. Sulphuric acid: contact process (no description) Physical properties, dehydrating action with Zn, Cu, salts, oxidising agents. Hydrochloric acid: physical properties, acidic nature, action with ammonia, silver nitrate, salts and uses.
Evaluation methods: written tests, written assignments, performance observation	**Teaching/Learning activities and resources:** classroom instruction, problem solving exercises, demonstrations
5.4.: Non metals	**Hrs. theory 6**
Objectives	Contents
1. Explain Hydrogen - physical properties and reaction. 2. Explain Oxygen-physical properties, and reaction 3. Explain Carbondioxide- physical properties and reaction. 4. Explain Ammonia and manufacture by haber's process. 5. Explain physical properties, chemical properties with H_2O, O_2, Na, AgCl, $CuSO_4$, nessler's reagent and uses. 6. Describe general characteristics of halogens	Hydrogen- physical properties, reaction with O_2, Na, Ca, X_2, N_2, vegetable oil, uses, heavy water, isotopes of hydrogen. Oxygen-physical properties, reaction with C, Ag, Na, H_2, SO_2, NH_3, N_2, uses. Carbondioxide: physical properties, reaction with Na, Mg, H_2O, lime water, carbon, iron, and uses. Ammonia: manufacture by haber's process.(principle with diagrammatic sketch.) Physical properties, chemical properties with H_2O, O_2, Na, AgCl, $CuSO_4$, nessler's reagent and uses. General characteristics of halogens
Evaluation methods: written tests, written assignments, performance observation	**Teaching/Learning activities and resources:** classroom instruction, problem solving exercises, demonstrations
5.5.: Minerals	**Hrs. theory 3**
Objectives	Contents
1. Describe the need of minerals 2. Find their sources and importance.	Sources of the followings minerals-Na, K, Ca, Mg, Fe, Zn, Ni, Cobalt 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
5.6: 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.
5.7: Cycles and Elements	**Hrs. theory 3**
Objectives	Contents
Identify of Natural cycles or green house effect.	i) Oxygen Cycle ii) Nitrogen Cycle iv) Carbon Cycle and v) Water cycle

Chemistry Practical

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	Procedural rules and guidelines of the chemistry lab Proper handling of equipment

documentation	Lab safety measures 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.	The correct operation of the Bunsen burner. Parts of the Bunsen burner 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 6**
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 i. Solution-A= $BaCl_2$ ii. Solution-B =H_2SO_4 4. Prepare a sample of clearly pure distilled water from impure water and carry out the test for	The process and methods of filtration Characteristics of filtrate and residue Chlorides ion test. Nature of mixtures and components Principles and processes of sublimation

purity of water thus prepared. 5. Prepare a sample of bazaar copper sulphate at laboratory temperature and use the solution to get pure crystals of salts. 6. Obtain sodium chloride by the neutralization of: i. Bench of hydrochloric acid with a bench of sodium hydroxide. ii. Sodium carbonate with hydrochloric acid 7. Prepare a soluble derivative of barium carbonate and sodium chloride	Characteristics of sublimation Characteristics of precipitation Principles and process of precipitation. The distillation process Properties of pure water Characteristics of saturated solutions Crystallization point and crystallization process Acid base reactions The principles and process of evaporation. 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 12**
Practical 1. Preparation of gases	Hrs. theory Hrs lab 6
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 6
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 8**
Practical 1: Equivalent weights	Hrs. theory Hrs. lab 4
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 4**

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 8**
Practical 1. Element detection	Hrs. theory Hrs lab 4
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 4
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 22**
Practical 1: Identification of Agriculture products containing carbohyderate, protein and lipids	**Hrs. lab 6**
Objectives	*Contents*
Prepare the list of Agriculture products containing carbohydrate, protein and lipids	• Making a list and identification of the Agriculture 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. lab 6**
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 PH value of the given sample of the soil.
Evaluation methods: practical performance, test, viva	**Teaching learning activities and resources:** classroom instruction, demonstration.

Botany

Credit hours: 4+1 hrs/week **Full Marks: 100**

Total hours: 192

Theory: 128

Practical: 64

Course Description:

This course aims at providing basic knowledge of Botany to certificate level students of Agriculture. 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 provides information on plant anatomy. Unit four is about physiology, which covers knowledge about membrane transport, transpiration, photosynthesis and respiration. Unit five 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. The sixth unit gives information about embryology of angiosperms. The seventh unit tells about different aspects of genetics. The eighth unit gives introduction to economic and ethno botany. Unit ninth gives the account of biotechnology including tissue culture and genetic engineering. This chapter also focuses on morphology of five common taxonomic families.

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.

Mahat, Ras Bihari, *A text book of Biology part I and Part II*

Reference Books

Chaudhary, R. P. *Biodiversity in Nepal Statud and Conservation.* S. Devi, Saharanpur (U. P.), India and Tecpress Books, Bangkok, Thailand.

Pandey, B. P. *Plant Anatomy.* S. Chand and Company Ltd, New Delhi, India.

Pandey, B. P. *Economic Botany.* S. Chand and Company Ltd, New Delhi, India.

Alexopolos, C. J. *Introductory Mycology.* John Wiley and Sons, New York.

Vasishta, P. C. *Botany for Degree Students (vol 5) Gymnosperms.* S. Chand and Company Ltd, New Delhi, India.

Lawerence, C. H. M., *Taxonomy of Vascular Plants.* McMillan Company.

Bhojwani S. S. and S. P. Bhatnagar. *The Embryology of Angiosperms.* Vikas Publication, Delhi, 1993.

Dubey, R. C. *A Textbook of Biotechnology.* S. Chand and Company Ltd, New Delhi, India.

Jain, V. K. *Fundamentals of Plant Physiology.* S. Chand and Company Ltd, New Delhi, India.

Jain, J. L. *Fundamentals of Biochemistry.* S. Chand and Company Ltd, New Delhi, India.

HMG, Nepal. *Medicinal Plants of Nepal.* DPR, HMG, Nepal.

Toylor D.J., N.P.O. Green and G.W.S Stout. Biological science (Third Edition). Cambridge University Press.

Course: Botany	**Theory: 128 hrs Practicle 64 hrs**
Unit 1: Introduction to Botany	**Theory: 4 hrs**
1.1 Definition and Scope of Botany	**Theory: 4 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: 12 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.	Definition of cellular pool, biomolecules, micro and macromolecules, inorganic and organic molecules and monomers and polymers with examples.

Define 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:2 hrs**
Objectives	Contents
Give structure and properties of water. List the biological role of water in living systems.	Structure, properties and biological role 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: 2 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: 2 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. List function of Nucleic acids.	Definition, types, examples and functions of Nucleic acids Definition glycosidic, peptide and phosphodiester bonds.
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: Plant Anatomy	**Theory: 16 hrs**
3.1: Tissue and its types	**Theory: 8 hrs**
Objectives:	Contents
Define tissue Classify tissues as Meristematic, Permanent and Secretory List features of Meristematic tissues Give types of Meristematic tissues with examples Define permanent tissues Classify permanent tissues as simple and complex List basic features, distribution and function of different simple and complex permanent tissues Define secretory tissues Give types of secretary tissues, their examples	Definition of tissue Types of tissues- Meristematic, permanent and secretory Features of Meristematic tissues. Types and examples of Meristematic tissues- apical, intercalary and lateral; primary and secondary Classification of permanent tissues as simple and complex Basic features, distribution and function of different simple and complex permanent tissues Definition of secretory tissues Types of secretary tissues, their examples and

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.	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.
3.2: 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 root.	Internal structures of dicot and monocot stems Internal structure of dicot and monocot root.
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.
3.3: Anatomy of Dorsiventral and Isobilateral leaves	**Theory: 2 hrs**
Objectives	Contents
Describe internal structures of dorsiventral	Internal structures of dorsiventral leaves.

leaves. Describe internal structure of isobilateral leaves.	Internal structure of isobilateral leaves.
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.
3.4: Secondary growth	**Theory: 2 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.
Unit4: Plant Physiology	**Theory: 16 hrs**
4.1: Diffusion	**Theory: 4 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.	Definition of diffusion, concentration gradient and facilitated diffusion Factors affecting diffusion. Significance of diffusion.

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 .
4.2: Osmosis	**Theory: 3 hrs**
Objectives	Contents
Define osmosis and the terms related to osmosis- semipermeable, osmotic pressure, water potential, hypotonic and hypertonic solutions, endosmosis and exosmosis, plasmolysis and turgid and flaccid cells. List the significance of osmosis. Define active transport and give its significance.	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.
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 osmosis.
4.3: 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	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, diagrams and demonstration of transpiration.

(3 marks) and Long (7 marks).	
4.4: Photosynthesis	**Theory: 3 hrs**
Objectives	Contents
Define Photosynthesis. List some major photosynthetic pigments and identify their role, structure of chloroplast. Identify the sites of photosynthesis. List the major steps of photosynthesis. List the factors affecting photosynthesis.	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.
4.5: 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 and fermentation.	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 5: Taxonomy and Biodiversity	**Theory: 50 hrs**
5.1: Concept of Taxonomy	**Theory: 3 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.
5.2: System of classification	**Theory: 2 hrs**
Objectives	Contents
Define artificial, natural and phylogenetic systems of classification with examples and their differences.	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.

5.3: Concept of Biodiversity	**Theory: 6 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.
5.4: Virus	**Theory: 5 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.	Definition, general characteristics, chemical composition, and classification of virus Structure of Bacteriophase Process of viral replication Mode of transmission of virus Common viral diseases in plants. Economic importance of virus

List some viral diseases in plants. Describe the economic importance of virus.	
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.
5.5: 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 (structure of nostoc) 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.
5.6: Fungi	**Theory: 5 hrs**
Objectives	Contents
Define fungi.	Definition, general characteristics and

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.	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
5.7: 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
5.8: 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
5.9: Pteridophyta	**Theory: 3 hrs**
Objectives	Contents
Define Pteridophyta. Give general characteristics of Pteridophyta. Describe life cycle of fern with well-labeled diagram. Give economic importance of Pteridophytes.	Definition and general characteristics of Pteridophyta Description of life cycle of fern Economic importance of Pteridophytes
Evaluation: Oral and written tests, home assignment. **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
5.10: Gymnosperms	**Theory: 4 hrs**
Objectives	Contents
Define Gymnosperms. Give general characteristics of Gymnosperms. List major groups of living Gymnosperms with	Definition and general characteristics of Gymnosperms. Major groups of living Gymnosperms and representative species of each group

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.	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
5.11: Introduction to Angiosperms	**Theory: 2hrs**
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) and Short (3 marks).	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts and diagrams
5 .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,	Description of angiospermic plants in semi technical terminologies. habit; general types, parts, features, modifications of root, stem, Leaf, inflorescence, flower

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).	
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
5.13: Study of some Angiosperm families	**Theory: 6 hrs**
Objectives	Contents
Discuss the characteristic features of some common Angiosperm families with examples and economic importance: Asteraceae, Poaceae, Cruciferae, Solanaceae, Fabaceae.	Description of characteristic features of some common Angiosperm families with habit, habitat, examples and economic importance of each: Asteraceae, Poaceae, Cruciferae, Solanaceae and Fabaceae.
Evaluation: Oral and written tests, home assignment. **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
Unit 6: Embryology of Angiosperms	**Theory: 10 hrs**
6.1: Reproduction	**Theory: 3 hrs**
Objectives	Contents

Define asexual reproduction Mention types of asexual reproduction in plant.	Definition of asexual reproduction. Types of asexual reproduction in plant.
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.
6.2: 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.
6.3: Fertilization	**Theory: 4 hrs**
Objectives	Contents
Define fertilization. Describe the structure of a typical angiosperm ovule with diagram.	Definition of fertilization. Structure of a typical angiosperm ovule with diagram

Describe the process of pollen germination, pollen tube development, double fertilization and triple fusion in angiosperms.	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 7: Genetics	**Theory: 5 hrs**
7.1 Heredity and Variation	**Theory: 2 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, alleles, genotype and phenotype, homozygous and heterozygous and clone.	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
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.
7.2 Mendel's Law of Inheritance	**Theory: 3 hrs**
Objectives	Contents
Explain Mendel's experiments. List the reasons for selecting pea plant by Mendel in his experiment.	Description of Mendel's hybridization experiments-monohybrid and dihybrid crosses Description of Mendel's laws and ratios

Define monohybrid and dihybrid crosses. Mendel's laws: Law of dominance, Law of Segregation, law of independent assortment.	
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.
Unit 8: Economic Botany	**Theory: 7 hrs**
8.1: 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.
8.2: Medicinal Plant	**Theory: 2 hrs**
Objectives	Contents
List some important medicinal plants of Nepal.	Some important meditional plants of Nepal and their uses.
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.**

8.3: 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.
Unit 9: Biotechnology	**Theory: 8 hrs**
9.1: Introduction to Biotechnology	**Theory: 3 hrs**
Objectives	Contents
Define Biotechnology. List the branches of Biotechnology. List the application of Biotechnology.	Definition, branches and applications of Biotechnology.
Evaluation: Oral and written tests, home assignment. **Types of questions:** Very short (1 mark) and Short (3 marks).	**Teaching Methods or Materials:** Classroom instruction, textbooks, reference books, charts, and diagrams.
9.2: Plant Tissue Culture	**Theory: 3 hrs**
Objectives	Contents
Define *in vitro* culture. Define cell, tissue, and organ culture. Define cellular totipotency.	Definition of in *vitro* culture, cell, tissue and organ culture. Definition of 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 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.
9.3 Introduction to Plant Breeding	**Theory: 2 hrs**
Objectives	Contents
Define plant breeding. List and define the methods of plant breeding (Hybridization). 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.

Botany Practical

Course: Botany Practical	**Hours: 64**
Practical 1: Molecular Biology	**Practical: 8 hrs**
Objectives Test presence of reducing sugars in the given	**Contents** Benedict test of Reducing Sugar.

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.	Iodine test of Starch. Biuret test of Proteins. Emulsion test of lipids.
Evaluation: viva voce, home assignment.	**Teaching Methods or Materials:** Lab instruction, practical activity, text books.
Practical 2: Plant Breeding	**Practical: 6hrs**
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: 6 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: 6 hrs**
Objectives: Describe the structure and functioning of a	**Contents:** Structure and functioning of a compound

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.	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: 12 hrs**
Objectives Study diffusion using copper sulphate crystals put in a beaker of water. Study osmosis through egg membrane. Study the rate of transpiration under different environmental conditions using Ganong's potometer. Demonstrate experimentally that oxygen is evolved during photosynthesis. OR Demonstrate experimentally that carbon dioxide is necessary for photosynthesis. Demonstrate that carbon dioxide is evolved during aerobic respiration. Demonstrate that carbon dioxide is evolved during fermentation.	**Contents** Study of diffusion using copper sulphate crystals put in a beaker of water Study of osmosis through egg membrane Study of the rate of transpiration under different environmental conditions using Ganong's potometer Demonstration of evolution of oxygen during photosynthesis. OR Demonstration of requirement of carbon dioxide during photosynthesis Demonstration of evolution of carbon dioxide during aerobic respiration Demonstration of evolution of carbon dioxide during fermentation
Evaluation: Viva voce, home assignment, evaluation of lab procedures.	**Teaching Methods or Materials:** Lab instruction, textbooks, charts, use of instruments and equipments.

Practical 6: Taxonomy and Biodiversity	**Practical: 22 hrs**
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 of structure and reproduction of *Marchantia* using fresh or preserved materials 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 the structure and reproduction of fern using fresh or preserved materials and permanent slides
Study of the male and female cone of *Pinus.*	Study of male and female cones of *Pinus*
Study the morphology and T. S. of *Pinus* needle.	Study of morphology and anatomy of *Pinus* needle
Taxonomy of Angiosperms:	**Taxonomy of Angiosperms:**
Study different types of modification of root, stem and leaf.	Study of some modifications of root, stem and
Describe the representative plants of angiospermic families in semi-technical terms	

(Brassicaceae, Solanaceae, Fabaceae, Asteraceae and Poaceae).	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: 4 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.

Zoology

Credit hours: 4+1 hrs/week **Full Marks: 100**

Total hours: 192

Theory 128

Practical: 64

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.128 HRS** **Practical -64 Hrs**
Unit: 1 introduction to zoology	**Hrs. 2 theory**
1.1 definition, scope and branches of Zoology	**Hrs. 2 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, Helminthology, 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. State the meaning of cyclosis, exocytosis and endocytosis	Ultra structure of different cell organelles and their functions: Cytoplasmic contents: cellmembrane mitochondria, endoplasmic reticulum, glogi complex, lysosome , centrosome, vacuoles, cilia and flagella Nucleoplasmic contents: chromosomes, nucleolus, nuclear membrane Difference between cytoplasm and nucleoplasm Meaning of cyclosis, exocytosis and endocytosis.

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. 12 theory**
Objectives	*Contents*
Define cell cycle, amitosis, mitosis and meiosis. Describe amitosis cell division. Explain the significance of amitosis cell division. Describe the steps of mitotic cell division using a labeled diagram. Explain the significance of mitosis. Describe the steps of meiotic cell division with necessary sketches. Explain why meiosis is called reductional division and is important in sexually reproducing organisms. Explain the significance of meiosis. Distinguish between mitosis and meiosis.	Definition of cell cycle. 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.
Unit:3 Cell biology, Tissues and their types	**Hrs. 5 theory**
3.1 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: 4 Diversity of animal life	**Hrs. 6 theory**
4.1 concept of taxonomy	**Hrs. 2 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.
4.2 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 : 5 Animal phylogeny and classification	**Hrs.12 theory**
5.1 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: 6 Basic concept of origin and evolution of life.	**Hrs. 8 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 7: 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: 8 Study of some economically important insects.	**Hrs. 8 theory**
Objectives	*Contents*
Give the systematic position, habit, habitat, life cycle of Honey bee and Silk worm. Describe the morphology of Honey bee and Silk worm with sketch. Morphology & life cycle of liverfluck & tapeworm Economic importance of Honey bee, Silk worm Characters of silk thread.	Systemic position, habit and habitat, life cycle, structure, and economic importance of Honeybee and Silkworm. Morphology & life cycle of liverfluke & tapeworm.
Evaluation methods: oral test, home assignments,	**Teaching learning activities and resources:**

written examination.	classroom instruction, discussion, textbook, and reference book self study.
Unit 9: Study of life process of mammals	**Hrs. 28 theory**
Objectives	*Contents*
Give the systematic position and morphology of man with sketch. Describe the digestive system, respiratory system, circulatory system, reproductive system, excretory system of man, Endicrine system & sensse organs-eye, ear.	Systemic position and morphology of man. Digestive system, Endocrine glands. Respiratory system, Sense organ-eye, ear Circulatory system. Reproductive system Excretory system and Nervous system
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbook, and reference book self study
Unit 10: Ecology and environment	**Hrs. 22 theory**
10.1 Ecosystem	**Hrs. 8 theory**
Objectives	*Contents*
Define ecosystem and its types. Identify major types of ecosystem- aquatic and terrestrial ecosystems List abiotic and biotic factors of different ecosystems. Identify the interacting system of biotic factors: Positive interactions-commensalism, mutalism, colonization, and social organization Negetive interactions- predation, parasitism, competition and antibiosis. Define food chain and trophic level. Develop a diagrammatic representation of food	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 ecosystem.

chain. Describe energy and energy relations in an ecosystem.	
Evaluation methods: oral test, home assignments, written examination	**Teaching learning activities and resources:** classroom instruction, discussion, textbook, and reference book self study.
10.2 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.
10.3 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	Description of greenhouse effect, acid rain and depletion of the ozone layer. Description of global warming & its effects.

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: 10.4 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. List the source of soil pollution. List the effects of soil pollution. List the preventive measures to control soil 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. Source of soil pollution, their effect and preventive measures.
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 adaptation	**Hrs.4 theory**
Objectives	*Content*
Define adaptation.	Meaning of adaptations

Define the aquatic adaptation with examples. Define the terrestrial adaptation. List the different types of terrestrial adaptations along with examples.	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 : 12. Animal behavior	**Hrs. 4 theory**
Objectives	*Contents*
Define the reflex action. Define the taxes and their types. Explain leadership and qualities of a leader. List some common examples of leadership in animals.	Definition of learned behavior and inborn behavior Definition of reflex action 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: 13. 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.	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.

List the national parks and wildlife reserves of Nepal.	
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 64**
Unit 1: Use of the microscope	**Hrs. lab 2**
Objectives	*Contents*
Name different types of microscope and their parts. Handle a microscope properly. Draw a well labeled diagram of compound 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. 10 lab**
Objectives	*Contents*
Study the given slides, specimens Draw diagramestic of 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-Pigeon, 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. 4 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. 4 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 5: Preparation of temporary slides and their study**	**Hrs. 4 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. 6 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 them.	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. 8 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 them.	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 Rat	**Hrs.8 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 the abiotic and biotic factors of an ecosystem Define 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,	**Teaching learning activities and resources:** classroom instruction, demonstration, visit to field-

viva class activities.	pond, rivers, forest.
Course: Practical Zoology **Unit: 7 Study of an Ecosystem**	 **Hrs. 8 lab**
7.2 Grassland ecosystem	
Objectives	*Contents*
Define ecosystem. Define 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, visit to field – grassland, forest etc.

Second Year

1. Extension and Community Development
2. Agribusiness Management and Cooperative
3. Aquaculture and Fisheries
4. Statistics and Computer Application
5. Introductory Plant Science
6. Animal Nutrition and Fodder production
7. Animal Housing and Environmental Science
8. Animal Health l
9. Sheep, Goat and Swine Production

Extension and Community Development

Credit hours: (3+1) hrs/week **Full Marks: 100**

Total hours: 160

Theory: 96 hrs

Practical: 64 hrs

Course Description

This course provides the basic knowledge and skills in education and extension education for community development program to the students. These courses include education and extension education, their principle and philosophy, origin, and historical development of Agricultural extension in Nepal. The extension teaching method used in transfer of technology in innovation diffusion their planning, monitoring and evaluation process. This course also studies sociological concept and importance in community development, group formation and dynamic on social process, motivation, gender development, leadership development, social mobilization and need based training and their importance in agriculture development.

Course Objectives

This Course has the following Objectives:

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

- Define the education and extension education
- Explain principle, philosophy, teaching and learning in agricultural extension.
- Apply the knowledge of extension education in TOT, program planning, monitoring and evaluation of agricultural extension programs.
- State sociological concept and terms with group dynamics, leadership, social mobilization.
- Explain gender and development, type and methods used in need based training to motivate the people in rural development programs.
- Develop the knowledge and skills in identifying social problems, data gathering technique, analysis and presentation.
- Visit different district level line agencies and understand their program, strategy and organizational structure.
- Communicates effectively with individuals and group in variety of setting by using different means of communication.

Minimum Standards

Students must secure a minimum of 40 percent marks in theory and 60 percent marks in practical examination.

Text and Reference books:

1. Ban, A.W., Van Den and H.S. Hawkins. 1998.Agricultural Extension. S.K.Jain for CBS Publishers and Distributors, new Delhi.

2. Bhatnagar, O.P. and O.P. Dahama. 1998. Extension and Communication for Development. Oxford and IBH Publishing Co., Ltd. New Delhi.

3. Bhusan, V. and D.R. Sachdeva. 1994. An Introduction to Sociology. Kitab Mahal, Allahabad.

4. Chitambar, J,V. 1973. Introductory Rural Sociology. Wiley Eastern Ltd., India.
5. Dongol, B. B. S. 2004. Extension Education. Pratima Singh Dongol, Kathmandu, Nepal.
6. Khan, S.S. and J.S. Sah. 2001. Social Mobilization Manual based on Syanja Experience, Social Mobilization Experimentation and Learning Center, UNDP/IAAS.

7. Mathialagan, P. 2007. A text Book of Animal Husbandry & Livestock Extension. International Book Distributing Co.Lucknow, India.
8. Nakkiran S and G. Ramesh. 2010. Research Method in Rural Development. Deep and Deep Publication Pvt. Ltd.New Delhi.
9. Sandhu, A. A. 1993. A Text Book of Communication Process and Method. Raju Primlani for Oxford & IBH Publishing Company Pvt. Ltd. New Delhi, India.
10. Shankar Roa, C. N. 2011. Sociology. Principle of Sociology with an Introduction to Social thought. S. Chand & Company Ltd,New Deldi, India.
11. UNDP. 2001. Governance and Poverty Reduction: National Human Development Report, Kathmandu.
12. SSMP. 2004. Krishi Prashar ka Tarikaharu (training manual in Nepali) . Sustainable Soil Management Program. Balkhutole, Lalitpur, Kathmandu.

Course:	**Hrs. Theory : Hrs. Practical :**
Unit: 01. Introduction	**Hrs theory :03**
Objectives	Contents
Explain education, its type, role and importance in RD.	Meaning, concept and definition of education and its type, role and importance of education in rural development
Evaluation Methods: Assignment presentation and written exam.	**Teaching /Learning activities and resources:** Class room instruction (lecture), group discussion and assignment presentation.
Unit: 02. Extension Education System in Nepal.	**Hrs theory :10**

Objectives	Contents
• Define extension education. • Explain the history scope, objective and importance of extension education in rural development. • Describe organizational setup, Extension system and approaches used in Nepal.	Meaning, concept, origin and history of extension education. Objective, area and scope of extension education. Need and importance of extension education. Historical development of agricultural extension in Nepal. Organizational structure of Ministry of Agriculture and co-operatives. Agricultural Extension system and approaches used in Nepal. Present extension system used in Nepal
Evaluation Methods: Oral and written test.	**Teaching /Learning activities and resources:** Class room instruction and class discussion.
Unit: 03. Teaching and learning process.	**Hrs Theory 12**
Objectives	Contents
• State teaching and learning process, their elements and steps in effective teaching learning process. • Explain extension teaching method, communication and audio-visual aids used in agricultural development.	Meaning and concept of teaching learning. Elements and steps of teaching learning process. Principles and law of learning. Factor affecting adult learning Extension teaching method Individual method / contact Group method / contact Mass method / Contact Audio-visual aids – Meaning, concept, nature and classification

	Meaning, concept and definition of communication and their elements, function and role in agriculture development.
Evaluation Methods: Oral and written test.	**Teaching /Learning activities and resources:** Class room instruction (lecture), class discussion and visual (chart) presentation.
Unit:04. Transfer of technology.	**Hrs theory :04**
Objectives	Contents
Explain adoption diffusion process. Describe the factors, process and characteristics of innovation decision.	Meaning and concept of adoption, diffusion and innovation Adoption process, adopters category and adopters characteristics. Factor affecting adoption of innovation in decision making process.
Evaluation Methods: Written test exam.	**Teaching /Learning activities and resources:** Class room instruction, class discussion.
Unit: 05. Program planning, monitoring and evaluation in extension	**Hrs theory :06**
Objectives	Contents
• Define program, planning and program planning. • State the principles, type of program planning. • Explain the steps of monitoring and evaluation of extension programs	Meaning, concept and importance of program, planning and program planning. Principle of program planning. Type of program planning. Steps in program planning. Meaning and concept of monitoring and evaluation of extension program Basic steps in evaluating extension program

Evaluation Methods: Oral and written exam.	**Teaching /Learning activities and resources:** Class room instruction, class discussion.
Unit: 06. Basic sociological concept	**Hrs Theory 12**
Objectives	Contents
• Define sociology and rural sociology • Explain the importance of rural sociology and sociological concept and terminology.	Meaning, concept and definition of sociology and rural sociology. Importance of rural sociology in agricultural extension. Sociological concept and terminology: society, culture, Social process, Community, Association, Organization, Institution – Family, Marriage, Religion, Social norms, value, belief, custom, Caste and ethnicity, Role, status, position, power and prestige, Social group, social structure, socialization, social stratification .
Evaluation Methods: Oral and written exam.	**Teaching /Learning activities and resources:** Class room instruction (lecture), class discussion.
Course:	**Hrs. Theory : Hrs. Practical :**
Unit:07. Social mobilization and community development.	**Hrs theory :12**
Objectives	Contents
Explain the term social mobilization, it's history, experience and strategy. Identify the scope, role in different GOs and NGOs on community development.	Meaning, concept and purpose of social mobilization. History of social mobilization in Nepal. Lesson learned from the past experience from social mobilization. Local governance, decentralization for development strategy. Current strategy of decentralization in Nepal. Scope, role of Local agencies, community based

	Organization and NGOs in social mobilization. Principle of community development. Concept of sustainability development.
Evaluation Methods: Written test exam.	**Teaching /Learning activities and resources:** Class room instruction and group discussion.
Unit: 08. Group formation and group dynamics	**Hrs theory :12**
Objectives	Contents
• Explain the concept of group, their typology, importance and group formation procedure. • Explain co-operation, conflict, situation for conflict, intensity and conflict management or resolution technique.	Meaning, concept, type and importance of group, group formation procedure, group dynamics, group technique. Meaning, concept, type and role of co-operation. Meaning, concept, definition of conflict. Transition of conflict thought, situation for conflict, conflict intensity continuum (Measurement of conflict) and conflict resolution technique or management.
Evaluation Methods: Written exam.	**Teaching /Learning activities and resources:** Class lecture and group discussion.
Unit: 09. Rural leadership development.	**Hrs Theory 06**
Objectives	Contents
• Define the concept of leader and leadership. • Explain the role and characteristics of leader. • Discuss the selection, development and effectiveness of local leader.	Meaning, concept, type of leader and leadership. Basic elements and importance of leadership in extension. Qualities/characteristics, role leader in community development. Selection and development of local leader. Method of identify the local leader and leader effectiveness.

Evaluation Methods: Written exam test.	**Teaching /Learning activities and resources:** Class lecture and group discussion.
Unit: 10. Gender and development.	**Hrs theory :06**
Objectives	**Contents**
Explain the word gender and its origin. Describe WID, WAD and GAD Discuss gender issue in the context of Nepal. Explain the role of women farmers, gender need and gender analysis tools.	Meaning and concept of Gender. Origin of Gender and development. Concept of WID, WAD and GAD. Gender issue in the context of Nepal. Role of women farmers and gender issues in agriculture. Gender needs and its role. Concept of gender analysis tools.
Evaluation Methods: Written exam.	**Teaching /Learning activities and resources:** Class lecture, group discussion, brain storming.
Unit: 11. Need based training	**Hrs theory :04**
Objectives	**Contents**
• Explain the concept and importance of need based training. • Describe type of training. • Explain method, development and management of training program	Concept and definition of training. Need for farmer's training. Process of training. Type of training. Method of identifying the training needs. Development and management of training program.
Evaluation Methods: Written exam**.**	**Teaching /Learning activities and resources:** Class lecture, group discussion.

Unit: 12. Motivation	**Hrs Theory : 03**
Objectives	**Contents**
• Explain the concept of motivation and its purpose and process of motivation. • Identify the factor affecting motivation. • Describe the technique of motivation in developmental work,	Meaning, concept and definition of motivation. Purpose and process of motivation. Factor affecting motivation. Technique of motivation in community development program.
Evaluation Methods: Written exam and question answer.	**Teaching /Learning activities and resources:** Class lecture, group discussion.

Extension and community development Practical

Extension and community development Practical	**Hrs Practical : 30**
Practical 1: Visit farming community	**Hrs : one day (about 4-6 hour)**
Objectives	Contents
Observe the farming community. Identify and prioritize farmer's problems.	Identification and prioritization of farmer's problems.
Practical 2: Introduction to research and social survey	**Hrs :2:00**
Objectives	Contents
Identify the different researchable problems. Plan and implement the research process and surveying.	Research: Meaning, concept, definition and type of research.
Practical 3: Social sampling.	**Hrs :2:00**
Objectives	Contents
Identify sampling method and techniques	Meaning, concept and type or method or

used in social survey.	techniques of social sampling.
Practical 4: Questionnaire development	**Hrs :2:00**
Objectives	Contents
• Develop the knowledge and skill for questionnaire development for survey.	Meaning, concept, type and method of questionnaire development for surveying.
Practical 5: An introduction to data collection.	**Hrs :2:00**
Objectives	Contents
• Develop the knowledge and skills of data collection techniques.	Type of data, method of data collection.
Practical 6: PRA and RRA method and technique used in collection of information.	**Hrs :2:00**
Objectives	Contents
Develop the knowledge and skill for information gathering from PRA, RRA.	PRA and RRA technique
Practical 7: Data analysis	**Hrs :2:00**
Objectives	Contents
• Develop the skill of data analysis.	Different method used in data analysis.
Practical 8: Report writing and presentation	**Hrs :2:00**
Objectives	Contents
• Develop the knowledge and skills in report writing and presentation.	Format of writing the report for presentation.
Practical 9: Preparation of poster, chart and flash cards.	**Hrs :2:00**
Objectives	Contents
• Develop the skill of preparation poster, chart and flash cards.	Meaning, concept and technique of preparation of different type of visual aids.
Practical 10: Preparation of pamphlet, leaflet and booklet.	**Hrs :2:00**

Objectives	Contents
• Develop the skill of preparation on pamphlet, leaflet and booklet.	Meaning, concept and technique of preparation pamphlet, leaflet and booklet and their uses.
Practical 11: Conduct method demonstration	**Hrs :2:00**
Objectives	Contents
• Develop the knowledge and skill for conducting method demonstration.	Meaning, concept of method demonstration. Precaution used in method demonstration.
Practical 12: Visit and conduct result demonstration and farmer's field trial.	**Hrs :2:00**
Objectives	Contents
• Develop the knowledge and skill for result demonstration. • Observe farmer's field trial (FFT).	Meaning, concept of result demonstration. Precaution used in method demonstration.
Practical 13: Visit District level Agriculture / Veterinary office and Vet. hospital.	**Hrs :4:00**
Objectives	Contents
Visit district level program, planning and implementation mechanism.	Program, planning, strategy and group formation process.
Practical 14: Preparation of individual level farm production plan for farm family.	**Hrs :2:00**
Objectives	Contents
• Develop the skill for preparation of individual level farm production plan.	Steps used in farm production plan. Precaution of farm production plan building.
Practical 15: Preparation of training program	**Hrs :2:00**
Objectives	Contents
• Develop the knowledge and skills in preparation of training program.	Need of training, Type of training. Precaution of implementation training program.

Agribusiness Management and Cooperative

Credit hours: (3+1)/weeks **Full Marks: 100**

Total Hours: 160

Theory: 96 hours

Practical: 64 hours

Course Description

Farm Management, Agribusiness Management and Cooperative course is divided into three sections. They are:

Farm Management

Farm Management section covered introduction to Farm Management; importance of farm management and problems related to management of firms in Nepal; production relationship; principles involved in farm management decisions; farm planning; farm budgeting; farm inventory and records keeping; and farm efficiency measures.

Agribusiness Management

Agribusiness Management section covered the concept, definition and scope of agribusiness management; basic concept firms, plant, industry and their interrelationships of agricultural commodities; agribusiness environment and management systems; human resource, Organization and business management functions; preparation of financial statements, analysis and agribusiness financing; and investment appraisals; value chain analysis: concept, mapping and approaches; Production planning in agribusiness; national and International trade in High Value Crops (HVCs); and agricultural policies in agribusiness enterprises

Cooperative

Under cooperative section, the concept of cooperatives, cooperative operation in commercial farming and role of cooperative in agricultural commercialization are major areas for group's approach in agriculture commercialization.

Course Objectives

This Course has the following Objectives:

To acquaint the students with the principles of farm management for taking the decision in agricultural production;

To familiar with value chain development of agricultural commodities for commercialization; and

To explain the role cooperative in different stages value chain development such as production, processing, distribution and consumption of agricultural commodities for sustainable agriculture commercialization.

Minimum Standards

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

Text and Reference books

Panda, S. C. (2007). Farm Management and Agricultural Marketing. Kalyani Publishers, New Delhi

Manson, J. (1996). Farm Management. Kangaroo Press, Pennsylvania State University.

Kay, R.D. and Edwards, W. M. (1994). Farm Management. McGraw Hill, Inc., New Delhi.

Kahlon, A. S. and Singh, K. (1992). Economics of Farm Management in India. Allied Publishers, New Delhi.

Shankhyan, P. L. (1983). Introduction to Farm Management, Tata, McGraw-Hill, Co. Ltd., New Delhi.

Johl, S. S. and Kapoor, T. R. (1973). Fundamentals of Farm Business Management. Kalyani Publishers, New Delhi.

URL: http://www.acsbookshop.com/products/1657-farm-management.aspx

Downey, W. D. and Erickson, S. P. (1987). Agribusiness management. McGraw Hill Inc.

Rhodes, V. J. (1983). The agricultural marketing systems. John, Wiley, and sons, Inc. Singapore.

Gittinger, J. P. (1982). Economic Analysis of Agricultural Projects. 2nd eds completely revised and expanded. The John Hopkins University Press. London.

Fae, A. N. (1981). Crop Management Economics. Granada publishing. London.

Courses:	**Hrs. Theory: 96 Hrs. Practical : 64**
A. Farm Management	
Unit 1: Introduction to Farm Management	**Hrs Theory 3**

Objectives	**Contents**
Familiar with farm and farm management, nature and scope of farm management in agriculture. Develop the efficient utilization of farm resources for output maximization.	Definition, nature and scope Management of farm resources 1.2.1 Land Management 1.2.2 Farm Layout 1.2.3 Soil and nutrient management 1.2.4 Mechanization
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 2: Importance of farm management and problems related to management of firms in Nepal	**Hrs theory 2**
Objectives	**Contents**
Understanding of farm management in farming system. Familiar with problems of farm Nepalese context	2.1 Importance of farm management 2.2 Problems related to management of firms in Nepal
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 3: Production relationship	**Hrs Theory 10**
Objectives	**Contents**
Explain the factor- product relationship such as production functions and law of return; Familiar with input- input relationship such as isoquant, iso- cost line and least cost	Factor- product: production function, law return Factor –factor: isoquent, iso-cost line, least

combination; and Understand the product- product relationship such as joint, complementary, supplementary, competitive products and opportunity cost.	cost combination 3.1 Product- product: joint, complementary, supplementary and competitive products and opportunity cost
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 4: Principles involved in farm management decisions	**Hrs Theory 10**
Objectives	**Contents**
Explaining the principle of diminishing return, cost principles and substitution effects; Enable the combining the enterprises and equilibrium return; and Familiar with the comparative advantage and time comparison for taking the decision for production of agricultural commodities.	Principle of diminishing return Cost principle Principle of substitution Principle of combining enterprises Principle of equilibrium return Principle of comparative advantage Principle of time comparison
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 5: Farm planning	**Hrs Theory 3**
Objectives	**Contents**
Understanding the principles and characteristics farm planning Familiar with farm planning techniques	Principles and characteristics of farm planning Techniques of farm planning
Evaluation Methods: Oral and written tests,	**Teaching /Learning activities and resources**:

assignment	Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 6: Farm budgeting	**Hrs Theory 5**
Objectives	**Contents**
Familiar with enterprise, partial and complete budgeting. Develop the knowledge of farm planning and budgeting.	Enterprise Budgeting Partial Budgeting Complete budgeting Steps in farm planning and budgeting
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 7: Farm inventory and records keeping	**Hrs Theory 7**
Objectives	**Contents**
Develop the skills farm records keeping; Familiar with the calculation of depreciation; of farm machinery; and Develop the knowledge of preparing balance sheet, income statement and cash flow statement.	7.1 Farm records keeping 7.2 Calculation depreciation 7.3 Balance sheet 7.4 Income statement 7.5 Cash flow statement
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 8: Farm efficiency measures	**Hrs Theory 5**
Objectives	**Contents**
Familiar with and able to calculation of different farm efficiency measures.	8.1 Physical efficiency 8.2 Financial efficiency

	8.3 Different ratios
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
B. Agribusiness Management	
Unit 9: Concept, definition and scope of agribusiness management	**Hrs Theory 2**
Objectives	**Contents**
Acquaint the concept and definition of agribusiness management; and Widen the scope of agribusiness management in Nepal.	9.1 Concept and definition of Agribusiness Management 9.2 Scope of agribusiness management in Nepal
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 10: Basic concept firms, plant, industry and their interrelationships of agricultural commodities	**Hrs Theory 2**
Objectives:	**Contents**
Familiar with firm, plant and industries and their relation for commercialization of agricultural commodities.	10.1 Basic concept and definitions of firms, plant and industry 10.2 Interrelationships of firm, plant and industries with respect to agricultural production
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 11: Agribusiness environment and management systems,	**Hrs Theory 2**

Objectives:	**Contents**
Develop the concept of agribusiness environment and management in agribusiness.	11.1 Discussion of Agribusiness environment for commercialization 11.2 Management systems in agribusiness
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 12: Human resource , Organization and business management functions	**Hrs Theory 4**
Objectives:	**Contents**
Enabling human resource management in organization, business management and managerial decision process in agribusiness.	12.1 Human resource management in organization 12.2 Organization and business management functions; and 12.3 Managerial decision process in agribusiness
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 13: Preparation of financial statements, analysis and agribusiness financing; and investment appraisals	**Hrs Theory 4**
Objectives:	**Contents**
Develop the financial statements, analysis and agribusiness financing; and Using the project investment appraisal criteria.	13.1 Preparation of financial statements, analysis and agribusiness financing 13.2 Investment appraisals through use of discounted and appraisal measures
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference

	books.
Unit 14: Value chain analysis: concept, mapping and approaches	**Hrs Theory 5**
Objectives	**Contents**
Developing the concept of value chain development; and Understanding the value chain development of some High Value Crops.	14.1 Value chain analysis: concept, mapping and approaches 14.2 Value chain analysis some High Value Commodities (Vegetables, Fruits, Livestock and high value crops)
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 15: Production planning in agribusiness	**Hrs Theory 4**
Objectives	**Contents**
Familiar in production planning in agribusiness; and Understanding of understanding and risk management.	15.1 Production planning in agribusiness 15.2 Uncertainty and risk management
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 16: National and International trade in High Value Crops (HVCs)	**Hrs Theory 3**
Objectives	**Contents**
Understanding of national and international; and their impact in agricultural commercialization.	16.1 Implications of National Trade of HVCs 16.2 Implication of International trade in agriculture sector of Nepal
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration,

	diagrams, visuals, textbooks, and reference books.
Unit 17: Agricultural policies in agribusiness enterprises	**Hrs Theory 4**
Objectives	**Contents**
Familiar with Nepal Government policies in agricultural commodities commercialization and their impact agribusiness enterprises.	17.1 Agricultural policies in agricultural commercialization 17.2 Agricultural policies and their impact on agribusiness enterprises in Nepal
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
C. Cooperatives	
Unit 18: Concept of Cooperatives	**Hrs Theory 5**
Objectives	**Contents**
Understanding the definition, organizational structures, cooperative laws and by- laws; Familiar with the roles of cooperative in commercial farming	Definition Organization/ structures Roles of Cooperative in commercial farming Cooperatives laws and by- laws
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 19: Cooperative Operation in Commercial farming	**Hrs Theory 5**
Objectives	**Contents**
Describing the cooperative formation, executive members, regular meeting and saving process;	Formation of Cooperative and its executive members

Develop the format farm records keeping and double entry book keeping system; and Understanding of social auditing and regular auditing of cooperative.	Regular meetings and saving Record keeping and double entry record keeping Social auditing Regular auditing in cooperative
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 20: Role of Cooperative in Agricultural Commercialization	**Hrs Theory 5**
Objectives	**Contents**
Familiar with contractual farming, cooperative farming and cooperating marketing; and Understanding the cooperative development in agriculture commercialization in Nepal.	Contractual Farming through Cooperative Cooperative farming Cooperative Marketing Cooperative development in agriculture commercialization in Nepalese experience
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources**: Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.

Farm Management, Agribusiness Management and Cooperative Practical

Farm Management, Agribusiness Management and Cooperative Practical	**Hrs Practical: 64 Hrs**
Farm Management	
Practical 1: Profit maximization	**Hrs : 4**
Objectives	Contents

Showing the optimum inputs use and maximization of profit by using one input	Determination of optimum input use and maximization of profit using one input
Practical 2: Least cost combination of inputs	**Hrs :4**
Objectives	Contents
Graphical presentation inputs combination for showing least cost combination	Least cost combination of inputs
Practical 3: Revenue maximization	**Hrs : 4**
Objectives	Contents
Principle of optimum enterprise combination for revenue maximization	Revenue maximization through optimum enterprise combination
Practical 4: Farm record keeping and farm inventory	**Hrs : 4**
Objectives	Contents
Able to prepare farm records and farm inventory keeping	Farm record keeping and preparation of farm inventory
Practical 5: Computation of depreciation	**Hrs : 4**
Objectives	Contents
Knowing the different methods of depreciation calculation	Computation of depreciation of farm assets
Practical 6: Balance Sheet of a farm	**Hrs : 4**
Objectives	Contents
Preparation of balance sheet of a farm before starting and at the end of year.	Preparation of Balance Sheet of a farm
Practical 7: Income Statement of farm	**Hrs : 4**
Objectives	Contents
Able to prepare of Income Statement of a farm	Preparation of Income Statement of farm

Practical 8: Farm efficiency measures	**Hrs :4**
Objectives	Contents
Analyzing the both physical and financial efficiency measures	Farm physical efficiency measures Farm financial efficiency measures
B. Agribusiness Management	
Practical 9: Production chain, market chain and supply chain	**Hrs : 4**
Objectives	Contents
Identify the production chain, market chain and supply chain for sustainability of value chain development.	Analysis of production chain, market chain and supply in value chain development in agribusiness management
Practical 10: Backward and forward linkages	**Hrs :4**
Objectives	Contents
Completion of backward and forward linkage of agricultural commodities.	Analysis of backward and forward linkages of major agricultural products
Practical 11: Preparation and analysis of profit and loss statement – A case study	**Hrs : 4**
Objectives	Contents
Developing the profit and loss statement	Preparation and analysis of profit and loss statement – A case study
Practical 12: Investment appraisals	**Hrs : 4**
Objectives	Contents
Showing the project appraisal criteria	Investment appraisals through discounted cash flow measures of project worth
Practical 13: Value chain development	**Hrs : 4**
Objectives	Contents
Understanding the value chain development and showing the relationship of chain actors.	Value chain mapping of major agricultural subsectors

Practical 14: SWOT analysis of major agricultural subsectors	**Hrs : 4**
Objectives	Contents
Showing every chain actors SWOT.	SWOT analysis of major agricultural subsectors
C. Cooperative	
Practical 15: Social auditing	**Hrs : 4**
Objectives	Contents
Enabling the social auditing of cooperative	Process of social auditing in cooperative operation
Practical 16:Finacial auditing	**Hrs : 4**
Objectives	Contents
Enabling the financial auditing of cooperative for smooth running	Financial auditing of cooperative at the end of year

Aquaculture and Fisheries

Credit hours: (2+1) hrs/week **Full marks:** 100

Total hours: 128

Theory: 64 hours

Practical: 64 hours

Course Description

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

Course Objectives

This Course has the following Objectives:

explain the importance of Aquaculture,

skill on different types fish farming system,

- describe basic knowledge of cultivated and food fishes of Nepal,
- demonstrate importance, knowledge of natural water body pond fish farming and management,
- Control management of common fish disease and marketing channel.

Minimum Standards

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

Text and Reference books

1. Principles of Aquaculture, M.K. Shrestha and N.P. Pandit
2. Fish Farming in Nepal , K.T Augusty
3. Fish Farming Hand Book, Fishing news book, Brown and Gratzek
4. Ichthyology of Nepal, T.K. Shrestha
5. Introduction to Fish Culture, T.K Shrestha and D.K. Jha
6. Elementary Guide to Fish Culture in Nepal, E. Woynarovich

Course:	**Aquaculture and Fisheries**
Unit- 1 Introduction	**Hrs. Theory : 10**
Objectives	Contents
• Define fish, fisheries and aquaculture • classification fishes of Nepal • General morphology, desirable characters for culture practices • Scope and importance of fish culture.	1.1 Definition of Fish, fisheries and aquaculture 1.2 General character of Fish 1.3 General morphology of Fish: external features, scale and fin of fishes 1.4 Principles, scope and importance of aquaculture in Nepal 1.5 Taxonomy of the fishes of Nepal 1.6 Desirable characters of fish for culture 1.7 Biology of cultivated indigenous and exotic fish species
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit-2 River and lake fisheries	**Hrs theory : 10**
Objectives	Contents
Define and classification of natural water body Rare and endangered species stoking for management Use of natural water body by different types of farming operation.	2.1.1 Classification of river lakes and assessment of natural water body 2.1.2 Fish culture in natural water body 2.2 Cage and pen fish culture 2.2.1 General consideration for cage and pen 2.2.2 Types of cage 2.2.3 Design and construction of cages 2.2.4 Cultivable species 2.2.5 Farming operations 2.2.6 Preservation and management of fish and fisheries
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 Pond fish culture	**Hrs theory : 30**
Objectives	Contents
Define and classification of different types fish farming system Cultivable and non cultivable fish pre-stoking and post-stoking management practices Control of aquatic weed and predatory fishes.	3.1 Pond types and construction Earthen pond 3.1.1 Cement pond 3.2 Commonly available fish species 3.2.1 Indigenous 3.2.2 Exotic 3.3 Fish feeds 3.3.1 Natural feeds 3.3.2 Supplemented feeds 3.3.3 Complete feeds 3.4 Techniques to develop natural feeds 3.5 Types of fish culture 3.5.1 Monoculture 3.5.2 Poly-culture 3.5.3 Integrated fish culture 3.5.4 Fish culture in paddy field 3.5.5 Running water culture 3.6 Cultural practices and management of pond fish culture 3.7 Stoking, pre and post stoking operations and management 3.8 Fish predators and their control
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 Fish breeding	**Hrs T Hrs theory: 15**
Objectives	Contents
• Define fish breeding, brood fish and their management • different types of breeding operation • Conditioning and transport of fish seed.	4.1 Role of fish seed in fish culture 4.1.1 Brood stock management 4.1.2 Types fish breeding 4.1.3 Natural, semi-artificial and artificial breeding 4.1.4 Induced breeding

	4.1.5 Spawning of fish 4.1.6 Incubating and hatching 4.1.7 Hatchling and rearing 4.1.8 Transfer to nursery pond
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 5 Live fish transportation	**Hrs theory: 5**
Objectives	Contents
• Define conditioning • Methods packing and use number of fish seed in packet or volume of water.	5.1 Conditions in transport of live fish 5.2 Causes of mortality in transportation 5.3 Condition of fish before transportation 5.4 Methods of packing and transport 5.5 Use of chemicals
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 6 Common fish diseases and parasites	**Hrs theory: 15**
Objectives	Contents
• Introduction of infectious and non-infectious fish disease • common fish disease, causal organism, symptoms and control measures of different fish diseases.	6.1 Common fish parasites and diseases in Nepal Causes and etiology 6.1.1 Symptoms and species affected 6.1.2 Types of fish disease, infectious and non infectious 6.2 Protozoan fish disease ,causal organism, symptom and control measures 6.3 Fungal fish disease ,causal organism, symptom and control measures 6.4 Bacterial fish disease ,causal organism,

	symptom and control measures 6.5 Worm and crustacean fish disease ,causal organism, symptom and control measures Non infectious diseases caused by water quality, nutrional and control measures.
Evaluation Methods: Oral and written test, assignment	**Teac Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 7 Marketing fish	**Hrs theory: 5**
Objectives	Contents
Introduction of fish marketing marketing channel Benefit cost analysis.	7.1 Packaging 7.1.1 Farm gate selling 7.1.2 Distant market selling 7.2 Pricing 7.3 Selling 7.4 Recording 7.5 Benefit cost analysis
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.

Practical

Aquaculture and Fisheries Practical	**Hrs Practical : 30**
Practical 1: Identify external and internal body parts of fish	**Hrs : 2**
Objectives	Contents
• To know external internal organs and their functions	External and internal organs of fish
Practical 2: Identify cultivated fish species	**Hrs 1**
Objectives	Contents
• Identification of cultivated fish species	Collect and identify of cultivated fish species
Practical 3: Lay-out fish pond	**Hrs 2**
Objectives	Contents
Site selection Measurement of area and volume of pond water.	Site selection and pond and lay-out different types of fish pond Measurement of area and volume of pond water.
Practical 4: Handle fish culture equipment safely	**Hrs 1**
Objectives	Contents
Arrangements of equipment in lab Safely.	Arrangements of equipment in lab
Practical 5: Take out the pituitary gland of fish	**Hrs 1**
Objectives	Contents

• To know location and functions of PG.	Dissecting tools
Practical 6: Preserve pituitary gland, make PG injection and apply to the fish	**Hrs 2**
Objectives	Contents
Breeding equipment	Dissecting tools Breeding equipment
Practical 7: Make use of water filtering structures/drainage devices	**Hrs 1**
Practical 8: Make bamboo cage	**Hrs 1**
Practical 9: Make bamboo gates for paddy fish culture	**Hrs 1**
Practical 10: Carryout fish culture practices	**Hrs 1**
Practical 11: Manage fish pond	**Hrs 1**
Practical 12: Maintain water level of fish pond	**Hrs 1**
Practical 13: Fertilize/manure fish pond	**Hrs 1**
Practical 14: Feed formulation and feeding of fish	**Hrs 1**
Practical 15: Identify/control aquatic weeds	**Hrs 1**
Practical 16: Collect/identify/control common parasites of fish	**Hrs 1**
Practical 17: Identify/treat/control common diseases of fish	**Hrs 1**
Practical 18: Identification of plankton	**Hrs 1**
Practical 19: Protect pond from predators/flood/erosion	**Hrs 1**
Practical 20: Carryout activities related to fish breeding	**Hrs 1**
Practical 21: Handle fingerlings	**Hrs 1**
Practical 22: Fertilize/manure fish pond	**Hrs 1**
Practical 23: Measure fish growth	**Hrs 1**

Practical 24: Carryout pond mud analysis	**Hrs 1**
Practical 25: Harvest of fish	**Hrs 1**
Practical 26: Fish marketing	**Hrs 1**
Practical 27: Measure fish growth	**Hrs 1**

Statistics and Computer Application

Credit hours: (2+1)/week **Full Marks: 100**

Total hours: 128

Theory: 64

Practical: 64

Course Description

This course is divided into two parts (a) Elementary statistics and (b) Computer application. Part one provides a basic overview of the elementary statistics and part two provides computer application in agricultural sciences. Course is intended to give knowledge on introduction to statistics, probability, collection, classification and Tabulation diagrams and graphs, central tendency, measure of dispersion, correlation coefficient in elementary statistics and in computer application, hardware requirements of computer, Operating Systems, Word processing, spreadsheet and database, presentation, graphic and multimedia, Web, Email and Internet, Virus and anti-virus definitions, Geographic Information System (GIS) and its application.

Course Objectives

- Define statistics and point out the uses.
- Define collection, presentation, and interpretation of numerical data with their procedure
- Define collect present or interpret numerical data following approximate procedure.
- 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

Mahajan B.K. Method of Biostatistics

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: Statistics and Computer	**Hrs. theory 64 Hrs. Practical 64**
Part I: Statistics	**Hrs. theory 32**
Unit 1 ***: Bio-Statistics***	**Hrs.theory 10**
1.1: Permutation, combination and binomial Expression	**Hrs.theory 10**
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 binomial theorem.	Introduction of basic principle of counting. 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. Application of formula in related problem of combination. Binomial theorem (Without proof). Finding general term, middle term and any particular term in the binomail expansion. Binomial coefficients. 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, oral tests.	**Teaching/Learning activities and resources:** Charts, models, graph boards, diagrams, classroom instruction, and teacher led discussion, demonstration of solutions, and illustration through practical examples, text

	and reference books.
Unit 2: Elementary Statistics	**Hrs theory 22**
2.1: Probability	**Hrs. theory 4**
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.

2.2: Introduction to statistics (Revision only)	**Hrs theory 2**
Objectives	Contents
Define statistics as given by different writers (Prof. Horace Secrist, Prof. Croxton & Cowden and Prof. Ya-Lu-Chan). State the utility, functions and limitations of statistics. Uses of statistics in various fields.	Definition of statistics by Prof. Horace Secrist, Prof. Croxton & Cowden and Prof. Ya-Lu-Chan. Utility, functions, limitation of statistics and its uses in various fields.
Evaluation methods: Written test exams and viva.	**Teaching/Learning activities and resources:** Classroom discussion, instruction, self-study, application of statistical methods textbook.

2.3: 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.
2.4: Central tendency	**Hrs theory 3**
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 in textbook.
2.5: Measure of dispersion	**Hrs theory 6**
Objectives	Contents
Calculate range, mean deviation from mean, median and mode, quartile deviation and standard deviation for ungrouped and	Calculation of 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	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 in textbook.
2.6: Correlation Coefficient	**Hrs theory 4**
Objectives	Contents
Define the concept of correlation. Define correlation method by drawing Scatter diagram. Explain Karl Pearson's coefficient of correlation between two variables.	Concept of correlation. Method of studying correlation by drawing Scatter diagram. Calculations of Karl Pearson's coefficient of correlation between two variables.
Evaluation methods: written exam, viva.	**Teaching /learning activities and resources:** classroom discussion, self study, application of process to given examples in textbook.

Part II: Computer application	**Hrs. theory 32 Hrs. Practical 32**
Unit 1 Introduction to computer	***Hrs. theory 5***
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 6**
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 6**
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 6**
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 4**
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 5***
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,	Teaching/Learning activities and resources:

home assignments, interaction at class, project, seminar	classroom instruction, illustrations, diagrams, visuals, textbooks, reference books

Statistics Practical

Course: Statistics Practical	Lab Hrs. 16
Practical 1: collection, Classification and Tabulation diagrams and graphs	**Hrs. practical 6**
Objectives	*Contents*
Prepare frequency tables (Individual, discrete and continuous). Draw simple subdivided, multiple and percentage bar diagrams. Draw pie charts and pictograms. Represent data on histograms, frequency polygons, frequency curve and Ogives.	Classification and tabulation of data. Presentation of data into simple bar diagrams, subdivided bar diagrams, multiple diagrams and percentage bar diagrams. Presentation of data into Pie charts and pictograms. Presentation of data into histograms, frequency polygons, frequency polygons and ogives.
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in the field.	**Teaching/Learning activities and resources:** Field visit, Group discussion, textbooks and reference books, journals and publications.
Practical 2: Central tendency	**Hrs. practical 6**
Objectives	*Contents*
Calculate mean of individual and grouped data Calculate median mathematically and graphically. Calculate the mode, 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 the mode, quartiles, deciles and percentiles.
Evaluation Methods: Written tests, Home assignments and presentation, participation/interaction in the field.	**Teaching/Learning activities and resources:** Field visit, group discussion, textbooks and reference books, journals and publications.

Practical 3: Measure of dispersion	**Hrs. practical 4**
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, median and mode. 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, Group discussion, textbooks and reference books, journals and publications.

Computer Application Practical:

Course: Computer Practical	**Lab Hrs 16**
Practical 1: Typing Tutor	Hrs 2
Objective	*Content*
Complete typing tutor	Type English Fonts Type Nepali Fonts
Practical 2: Work on MS Word 2006	Hrs 5
Objective	*Content*
Carry hands on Microsoft Word	Document creation Document formatting Document saving Document editing Document printing
Practical 3: Work on MS Excel 2006	Hrs 3

Objective	*Content*
Carry tutorials on MS Excel	Data entry in spreadsheet Data analysis Graphical presentation of data Tabulation and Printing
Practical 4: Work on MS Power point 2006	Hrs 3
Objective	*Content*
Carry tutorials on MS Power Point	Slide preparation Design, multimedia, proofreading, editing Saving and Opening Presentation and printing
Practical 5: Work on ArcView 3.x	Hrs 3
Objective	*Content*
Carry hands on ArcView 3.x	Layer creation Editing GIS data Database management in GIS Sybolization and Labelling Layout preparation and Printing

Introductory Plant Science

Total hours: (2+1)/week = 128 hrs **Full marks: 100**

Theory: 64 hours

Practical: 64 hours

Course Description:

This course provides basic knowledge on plant science including common technologies of horticultural and field crop production systems. It includes introductory part i.e. definition, branches, importance, ecological regions of horticultural and field crops in nepal, classification, terminologies and concept of different cropping system, environmental factors affecting crop production, soil and water management including cultural practices to improve and maintain soil fertility, growth and development of plant, introduction to plant growth regulators, introduction to fruit and plantation crops their propagation techniques, introduction to vegetable farming, classification of vegetables, introduction to common herbs and spices, introduction to ornamental horticulture, field crops classification of field crops, food situation etc

Course objectives

This course has the following Objectives:

Broad objective

- To provide basic knowledge of horticultural and field crop production systems.

Specific objectives

- To provide knowledge on achievements in the area of plant science.
- To provide knowledge on different cropping techniques.
- Describe about climatic and edaphic factors affecting crop production along with plant water relationship.
- To provide basic knowledge on vegetables, fruit and plantation crops, ornamental horticulture and field crop of Nepal.
- Apply technical skills in propagation techniques of different plants, identification of different seeds/plants, tools and equipments, fertilizers, insect and diseases etc.

Minimum Standards

Text and Reference books

- Shrestha, G.K., S.M. Shakya, D. R. Baral and D. M. Gautam. 2001. Fundamentals of Horticulture, Department of Horticulture, IAAS, Rampur.
- Mishra, N.K. et al., 1992. Introduction to Plant Science, IAAS, Rampur.
- Arora, J.S. 1990. Introductory Ornamental Horticulture, Kalyani Publishers, N. Delhi.
- Bal, J.S. 1990. Friuit Growing Kalyani Publishers.
- Bose, T.K. and S.K. Mitra. 1990. Fruits-Tropical and Subtropical Naya Prakash, Calcutta.
- Kumar, N., K. Abdul, P. Rangaswami and I. Irulappan. 2000. Introduction to spices, plantation crop, medicinal and aromatic plants. Oxford and IBH Pub. Co. Pvt. Ltd.
- Singh, S. P. 1989. Production on Technology of Vegetable Crops. Universal Pub. Centre, Karnal, India.
- Shanmugavelu, K. G. 1989. Production Technology of Vegetable Crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- Bose, T.K., M. G. Som and J. Kabir. 1993. Vegetable Crops. Naya Prakash, Calcutta.
- Randhawa, G.S. and A. Mukhopadhaya. 1986. Floriculture in India, Allied Pub. Ltd. New Delhi.

Unit: 1. Introduction	**Hrs Theory:** 6
Objectives:	Contents:
• Define agriculture • Explain the importance of horticultural and field crops. • Classification of fruits, vegetables, ornamentals and field crops.	• Definition and branches of agriculture • Importance of horticultural and field crops. • Feasibility of horticultural development in Nepal • Ecological regions and inches of horticultural and field crops in Nepal. • Classification of fruits vegetables, ornamental and field crops. • Crops as a components of Nepalese farming system
Evaluation methods: Oral and written test, assignments.	**Teaching/Learning activities and resources:** Classroom lectures, observation, illustration, diagrams, visuals, text book and reference books.
Unit: 2. Terminologies and concept	**Hrs Theory: 6**
Objectives	Contents
• To provide knowledge on terminologies and concept of different cropping system and agro-forestry. • Define farming system.	• Definition of farming system and its use in Nepalese context. • Explaining different types of cropping stem i.e. monoculture, multiple cropping, relay cropping, intercropping, mixed cropping, cover cropping, catch cropping. • Introduction to agro-forestry. • Explaining alley cropping and contour cropping.
Evaluation methods:	**Teaching/Learning activities and resources:**

Oral and written test, assignments.	Classroom lectures, observation, illustration, diagrams, visuals, text book and reference books.
Unit: 3. Environmental factors affecting crop production.	**Hrs Theory: 10**
Objectives	Contents
• To provide basic knowledge on environmental factors affecting crop production. • To provide knowledge on effect of temperature, light rainfall, humidity, hailstorm on growth and development of plants.	• Role of temperature, light, rainfall and humidity on growth and development of plants. • Adverse climatic conditions that affect the crop production. • Soil moisture and its impact on crop production.
Evaluation methods: Oral and written test, assignments.	**Teaching/Learning activities and resources:** Classroom lectures, observation, illustration, diagrams, visuals, text book and reference books.
Unit: 4 Soil and water management	Hrs theory : 12
Objectives: • To provide basic knowledge on soil and water management for crop production. • Essential plant nutrients and their functions. • Explain soil erosion and its impact. • Explain irrigation methods and cultural practices to maintain soil fertility.	**Contents:** • Chemical and physical properties of soils. • Essential plant nutrients and their functions. • Sources of plant nutrients. • Manures and fertilizers. • Soil erosion, types and its impact on crops production. • Cultural practices to improve and maintain soil fertility green manuring, mulching, cover crops, intercropping, crop rotation.

	• Methods of irrigation.
Evaluation methods: Oral and written test, assignments.	**Teaching/Learning activities and resources:** Classroom lectures, observation, illustration, diagrams, visuals, text book and reference books.
Unit: 5 Growth and development	**Hrs Theory:**14
Objectives: • Define growth and development. • Explain about germination, dormancy, juvenility, maturity, flowering and fruiting. • Explain fruit set, fruit growth and fruit drop. Ripening and senescence.	**Contents:** • Differentiate between and development. • Describe the germination process. • Dormancy and how to overcome dormancy. • Describe juvenility, maturity, flowering and fruiting. • Description of process of fruit set, fruit growth. • Fruit drop and how to minimize it. • Physiology of ripening and senescence.
Evaluation methods: Oral and written test, assignments.	**Teaching/Learning activities and resources:** Classroom lectures, observation, illustration, diagrams, visuals, text book and reference books.
Unit: 6 Plant growth regulators	Hrs Theory 12
Objectives: • To provide basic knowledge on plant growth regulators (PGR)/Phytohormones used in crop production. • Define PGR/phytohormones. • Classification of PGR and their role/use in	**Contents:** • Meaning and classification of PGRs. • Functions and use of PGR in agriculture. - Auxins, gibberelhns, cytokinin, ethylene, abscissic acid, retardants

crop production.	
Evaluation methods: Oral and written test, assignments.	**Teaching/Learning activities and resources:** Classroom lectures, observation, illustration, diagrams, visuals, text book and reference books.
Unit: 7 Introduction to fruit and plantation crops	**Hrs Theory :** 10
Objectives: • To provide basic knowledge on different fruit and plantation crops grown in Nepal. • Climatic requirement for different fruit and plantation crop. • Provide knowledge on layout plan of orchard for different planting methods. • Propagation techniques and training, pruning in fruit crops.	**Contents:** • Major fruit and plantation crop grown in Nepal. • Name, distribution, area and production of fruit/plantation crop in Nepal. • Layout of orchard and planting techniques. • Methods of propagating fruit and plantation crops. • Climatic requirement for commercial production of tropical, sub-tropical and temperate fruits.
Evaluation methods: Oral and written test, assignments.	**Teaching/Learning activities and resources:** Classroom lectures, observation, illustration, diagrams, visuals, text book and reference books.
Unit: 8 Introduction to vegetables	**Hrs Theory :** 5
Objectives: • To provide basic knowledge on different types of vegetables farming. • Introduction to different vegetables and spice corps. • Classification of vegetables and spice crop.	**Contents:** • Definition of vegetables. • Types of vegetable farming: kitchen, truck, peri-urban vegetables farming, off-season vegetable farming. • Status of vegetable production in Nepal.

	• Classification of vegetables on the basis of botany, growth habit, growing season, use and culture. • Nomenclature of different herbs and spice crops.
Evaluation methods: Oral and written test, assignments.	**Teaching/Learning activities and resources:** Classroom lectures, observation, illustration, diagrams, visuals, text book and reference books.
Unit: 9 Introduction to ornamental horticulture	**Hrs Theory :** 5
Objectives: • Define ornamental horticulture • Description on types of garden and their components. • Classification of ornamental plant. • Major ornamental plants grown in Nepal.	**Contents:** • Definition of ornamental plants. • Major components of garden. • Classification of ornamental plants on the basis of growth habit, season of flowering and on the basis of uses-flower, cut-flower, foliage, indoor and out-door. • Use of ornamental plants for different purpose.
Evaluation methods: Oral and written test, assignments.	**Teaching/Learning activities and resources:** Classroom lectures, observation, illustration, diagrams, visuals, text book and reference books.
Unit: 10 Introduction to field crops	**Hrs theory :** 10
Objectives: • To provide knowledge on importance of field crops, food situation in the country, classification of field crops.	**Contents:** • Importance of field corps. • Food situation-demand and supply in the country.

• To give relevant information on cereals crops, pulses, oil crops, cash crop and minor/indigenous crops.	• Classification of field crops. • Name, use, distribution, area and production of - Cereal crops: rice, wheat, maize and millets - Pulse crops: Lentil, soybean, cowpea, pigeon pea, chicke pea, black and green grams. - Oil crops: Mustard, groundnut, sunflower, sesame and linseed. - Cash/industrial crops: Sugarcane, cotton, tobaccos and jute. - Minor and indigenous crops.

Practical

Introductory Plant Science Practical	**Hrs practical:**
Practical 1: Identification of different field crops, fruits, vegetables, ornamental plants and their seeds.	**Hrs 4:**
Objectives: • To be familiar with field crops, fruits, vegetables, ornamental plants and their seeds.	**Contents:** • Identification of field crops, fruits, vegetables, ornamental plants, seeds. • Familiarization with their scientific name and family.
Practical 2: Identification of tools and equipments.	**Hrs: 2**
Objectives: • To be familiar with tools and equipments used for different agricultural activities.	**Contents** • Identification of different tools and equipments used to carry out different

	agricultural activities efficiently and properly.
Practical 3: Nursery bed preparation and sowing of seeds.	**Hrs: 2**
Objectives: • To be familiar with the procedure of nursery bed preparation along with techniques employed to obtain healthy seedlings.	**Contents:** • Different types of nursery bed. • Preparation of nursery bed and soil drenching. • Sowing of seeds and mulching. • Care and maintenance of nursery bed.
Practical 4: Identification of computation of chemical fertilizers	**Hrs: 2**
Objectives: • To be familiar with the different chemical fertilizers available in the market. • To know the methods of computation of chemical fertilizers required for given area.	**Contents:** • Identification of chemical fertilizers. • Computation of chemical fertilizers required for given area.
Practical 5: Land preparation and sowing of seeds of field crops and direct seeded vegetable crops	**Hrs: 4**
Objectives: • To be familiar with land preparation techniques and sowing the seeds of field corps and vegetables seeds (direct seeded).	**Contents:** • Methods of land preparation. • Sowing of seeds of field crops and vegetable crops (direct seeded).
Practical 6: Transplanting of vegetable seedlings.	**Hrs: 2**
Objectives: • To be familiar with the transplanting	**Contents:** • Criteria for selection of healthy seedlings.

techniques of different vegetables seedlings.	• Hardening of seedlings. • Transplanting techniques of seedlings.
Practical 7: Preparation of soil samples and determining soil pH.	**Hrs: 2**
Objectives: • To be familiar with the techniques of soil sampling, pH determination and calculating the dose of lie for acid soils.	**Contents:** • Preparation of soil samples. • Determination of soil pH. • Calculation of lime for acid soil.
Practical 8: Collection and identification of insect pest and diseases	**Hrs: 4**
Objectives: • To collect and identify different diseases and pest that attack the crops.	**Contents:** • Identification of diseases that attack the crops. • Identification of insect pest that attack the crops.
Practical 9: Practicing grafting, budding, air layering and cutting for propagating different crops/plants.	**Hrs: 4**
Objectives: • To be familiar with different method of propagating fruit crops.	**Contents:** • Vineer grafting and inarching • 'T' budding • Air layering • Cutting (herbaceous, soft wood, semi-hard wood and hard wood cutting).
Practical 10: Training and pruning of fruit trees	**Hrs: 2**
Objectives: • To be familiar with the techniques of training and pruning of fruit trees.	**Contents:** • Training of fruit trees. • Pruning of fruit trees.

	• Advantages of training and pruning.
Practical 11: Preparation of garden design for residential building, school and public parks.	**Hrs: 2**
Objectives: • To know the techniques for preparing layout plan of a garden design.	**Contents:** • Prepare a layout plan of a garden design for residential building, school and public parks.

Animal Nutrition and Fodder production

Credit hours: 3+1/weeks **Full Marks: 100**

Total hours: 160

Theory: 96 hours

Practical: 64 hours

Course Description

This course provides basic knowledge in animals and their feeds, importance and scope of animal nutrition, terminology, composition of plant and animal cells, classification of feedstuffs, roughages and concentration, functions and deficiency symptoms of nutrients, energy and protein rich feed ingredients and feeding standards, concept of energy and measures of energy, nutrient requirement of farm animals and birds, feed formulation, forages, their classification and cultivation practices, conservation of forages, pasture and natural grasslands, common fodder trees, agro forestry and silvipastarel systems.
Course objectives

Upper the successful completion of the course, students will be able to gain basic knowledge on animal feeds, nutrition, their functions and deficiency symptoms. They will also be to feed farm animal and poultry birds including cultivating forages, fodder and their cultivation.

Text and reference books

- A text book of animal nutrition: G.C.Banerjee.
- Animal nutrition: Mayhand and Looshi
- Poultry nutrition: N.L. Scott
- Animal nutrition in the Tropics: S.L. Shastry
- Nutrient Requirement of Dairy cattle.
- ,, ,, ,, Poultry. NRC, Washington D.C.
- ,, ,, ,, Swine.
- Handouts.
- Class notes.

Unit 1: Introduction

Objectives	Contents
1. Explain the importance and scope of animal nutrition. 2. Define common terms in nutrition. 3. Farm animals and for poultry birds and their feeds. 4 Composition of plant and animal cells.	Orient students to animal nutrition. Define terms : nutrients, nutrition, feed, food etc. Feed for ruminants and non ruminants. Composition of animal and plant cells.
Evaluation methods: Question-answer and reactions: Feeds.	Teaching, learning, activities and resources: Nutrient composition, tables. Charts

Unit 2 Feeding stuffs Hrs Theory: 4

Objectives	Contains
Energy rich feedstuffs. Protein rich feedstuffs. Differences between roughages and concentration . Differences between concentrate and non-roughage	Composition of feed ingredients. Classification of feeding stuffs. Roughages and concentration. Importance and use of un concentration l feedstuffs..
Evaluation methods: Class test	Teaching, learning, activities and resources: Nutrient composition, tables. Charts

Unit 3: Functions and deficiency symptoms of nutrients. Hrs Theory: 12

Objectives	Contains
Define nutrients and their functions and deficiency symptoms. Classify nutrients. Differentiate between essential and non essential nutrients.	Water Carbohydrates. Lipids (Fat and Oil) Essential fatty acids. Protein. Essential and non essential amino acids. Synthetics amino acids.
Evaluation methods: Oral and written test.	Teaching, learning, activities and resources. Classroom instruction, text books, diagrams, charts.

Unit 4 Minerals, vitamins and their functions Hrs Theory: 10

Objectives	Contains
Explain macro and micro (Trace) elements. Explain fat soluble and water soluble vitamins.	Macro elements: Ca, P,K, Na, Cl, S, Mg, Trace elements: Mn, Cu, Zn, Se,I, Fe Fat soluble vitamins: Vitamins A, D, E, and K Water soluble Vitamins: B-complex and Vit. C.
Evaluation methods: Prepare chart, Oral test	Teaching, learning, activities and resources.

	Classroom instruction, text books, diagrams, charts. Visuals.

Unit 5: Animal feeds Theory Hrs :10

Objectives	Contents
Explain energy rich feed ingredients Explain protein rich feed ingredients Formulation of ration Processing of feeds Feeding standards List down commercial feed industries and their production capacity in Nepal	Different kin d s of feed ingredients and their their characteristics Principals of feed formulation-processing, mixings and storage f feeds Feeding standards for farm animals and poultry Rule regulation and standard to establish feed industry in Nepal
Evaluation methods: Prepare chart, Oral test	Teaching, learning, activities and resources. Classroom instruction, text books, diagrams, charts. Visuals.

Unit 6: Energy Hrs Th 4

Objectives	Contents
Explain concept of energy Measures of energy Energy intake and partition in animal body	Heat energy Measure of food energy; gross energy, digestible energy, faecal energy, gaseous energy, urinary energy, heat increment, net energy
Evaluation methods: Prepare chart, Oral test	Teaching, learning, activities and resources. Classroom instruction, text books, diagrams, charts. Visuals.

Unit 7: Nutrient requirements Hrs Th 6

Objectives	Contents
Explain Nutrient requirement of farm animals and poultry birds Differenciate between feeding and nutrient requirements of ruminants and no ruminants	Nutrient requirement and feeding of dairy cattle, buffalo. goat sheep and poultry, swine, rabbit and equine
Evaluation methods: Prepare chart, Oral test	Teaching, learning, activities and resources. Classroom instruction, text books, diagrams, charts. Visuals

Unit 8 : Formulating balanced diets Hrs. Theory : 4

Objectives	Contents
Define of balanced ration Explain factors affecting the nutrient requirements Explain methods of feed formulation.	Balancing rations for cattle, buffalo, swine and poultry

Evaluation methods: Practice on feed formulation, class test.	Teaching/learning activities and resources : Compound ration on campus, text book, class instruction.

Unit 9 : Treatment of crop residnes. Hrs. Theory: 3

Objectives	Contents
Formulate ration Process ingredients Improve feeding value (Nutritive value) of crop by-products and resideres	Cropnutration and mixing of rations, processing ingredients, urea/NPN treatment of rice straw
Evaluation method : class test, formulation of ration	Teaching/ learning activities and resources: Parts of a feed mill, feed formulation, processing, mixing and storage, visit to a feedmill.

Unit 10 : Forage and pasture Hrs Theory : 4

Objectives	Contents
Define forage and pasture Clasify forages List different type of annual, perennial legume and non-legume forages Differentiate between pasture and natural grasslands	Termonology related to forage/fodder and pasture Importance and scope of fodder/ forage production and pasture management. Differentiation between pasture and natural grassland Classification of forage crops Factors affecting chemical composition and nutritive value
Evaluation methods : Oral and written test, assignment for preparing herbarium	Teaching/learning activities and resources: Forage speciments, fodder calendar, class instruction and reference books.

Unit 11: Cultivation of forages Hrs Theory: 20

Objectives	Contents
Define annual and perenrikl forage Define lesure and non-lesure forage Learn agronomical practices of forages.	Fodder/forage (maize, teosinle, bajra, oat, sorghumn, deenanath) Common perennial fodder/forage (napier, para, gninea grass, setaria, Rhodes grass, blue paric, molasses, paspalum) Common annual legumes (cowpea, pea, common vetch, berseem beans (LabLab) Common perennial legumes (Stylosan these, Lucern , Alfalfa, Kudju, Centrocae)
Evaluation methods : Oral and written test, assignment for preparing herbarium	Teaching/learning activities and resources: Forage speciments, fodder calendar, class instruction and reference books.

Unit 12 : Pasture, range, natural grassland Hrs. Theory : 4

Objectives	Contents
Define pasture, range and natural grassland Learn cultivation of pasture species Learn improvement of pasture, range and natural grassland	Introduction to pasture, range and natural grassland. Cultivation practices of common species for pasture, range and grassland (perennial rye grass, white clover, cooks foot) High hills and mountain animal grazing systems.
Evaluation methods : Oral ttest, class presentation.	Teaching/learning activities and resources: classroom instruction, illustration, diagrams, reference books.

Unit 13 : Forage seed production and fodder propagation techniques Hrs. Theory : 6

Objectives	Contents
Produc e forage seed Propagate fodder – sexual and asexual method	Metods of forafe seed production Sexual and asexual method of fodder propagation
Evaluation methods : Oral ttest, class presentation.	Teaching/learning activities and resources : classroom instruction, illustration, diagrams, reference books.

Unit 14 : Conservation of green forages Hrs. Theory : 4

Objectives	Contents
Define forage/fodder conservation Explain the importance of forage conservation Learn hay making Learn silage making	Introduction need and scope of forage/fodder conservation Hay making Silage making : different methods of silage making.
Evaluation methods : Oral test, written test.	Teaching/learning activities and resources : classroom instruction, field visit, reference book.

Unit 15 : Fodder trees and their role Hrs. Theory : 4

Objectives	Contents
Differentiate between common trees and fodder trees. Identify and grow cultivated species of fodder trees. Explain transplanting of fodder tree seedlings.	Introduction differences between timba trees, fodder trees and multipurpose trees. Different type of numseries for raising fodder tree seedlings. Name and characteristics of commonly grown fodder trees in Nepal.

Evaluation methods : Oral and written tests, assignment.	Teaching/learning activities and resources : classroom instruction, observation, diagrams and reference books.

Animal Nutrition and Fodder Production Practicals

Animal nutrition and fodder production practical.	**Hrs. Practical : 30**

Practical 1. Identification of common feed inggredients Hrs : 2

Objectives	Contents
1. Identify different feed ingredients 2. Differentiate and classify feed ingredients according to nutrient sources.	Visit to animal nutritia lab and observe feed ingredients collect different feed . Ingredients and display in a chart.

Practical 2. Identify common grasses, forage legumes and fodder trees. Hrs : 4

Objectives	Contents
1. Identify forage/fodder species and fodder trees 2. Prepare herbarium of forages	Visit to forage nursery or cultivated forage field Observe and identify sample in the laboratory.

Practical 3. Feed formulation Hrs : 4

Objectives	Contents
1. Formulate ration for cattle and buffalo 2. Formulate ration for swine 3. Formulate ration for poultry	Pearson square method Quadratic equation Hit and trial method

Practical 4. Cultivation practices of common annual and perennial grasses and legures Hrs : 6

Objectives	Contents
1. Learn cultivation of annual and perennial forages. 2. Learn seed treatment including ino colum 3. Learn cultivation of annual and perennial leguminums forages.	Field preparation Application of FYM and ferrilizer Sowing methods and sowing of speeds Irrigating the field

Practical 5. Preparation of seasonal calendar of forages Hrs : 2

Objectives	Contents
1. Be able to select forage to be grown throughont the year.	Class instruction and demonstruction. Determine, sowing and harvesting time of each fodder crops.

Practical 6. Dry matter (DM) and yield estimation. Hrs : 4

Objectives	Contents
1. Determine DM content in green, forage, silage and hay. 2. Determine yield of forages.	Practice in animal nutrition laboratory Harvest forage crage and weight it.

Practical 7. Derelop fodder tree nursery and poypots Hrs : 4

Objectives	Contents
1. Construct a fodder tree nursery 2. Prepare cutting 3. Prepare nursery beds 4. Demonstrate the practices of soil mixing, container filling and seed sowing	Nursery materials Nursery layouts Nursary bed preparation Preparation of nursery materials Seed treatment (if required) Seed sowing and caring.

Practical 8. Excusion and forage/fodder crops identification Hrs : 4

Objectives	Contents
1. Identify the forages in research stations or university farms.	Visit to Government research farms or university farms.

Animal Housing and Environmental Science

Total hours: (2+1)/week **Full Marks: 100**

Total hours: 128 hours

Theory:.64 hours

Practical: 64 hours

Course Description

This course provides basic knowledge on livestock housing also considering environmental concern to rear livestock species. Basically course describes pertinent aspects on livestock housing covering cattle and buffalo housing, housing of goats, sheep housing, and pig housing. Besides it also covers issues related to livestock housing and environment. The course also includes major reflection of environment to the livestock-climate influence, livestock and climate change, environment and animal well being, strategies to reduce the impact of heat and cold stress and effect of environment on animal health, immune functions and metabolism.

Course Objectives

This Course has the following Objectives:

a. To provide basic knowledge on common livestock housing system and their functions
b. To describe core concept of environment to the housing requirement and management of livestock rearing, and
c. To provide basic knowledge about environmental concerns to livestock including climate change, animal well being and strategies to reduce the adverse impact of climatic variability to the livestock

Minimum Standards

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

Text and Reference books

Banerjee, G.C. 2000. A textbook of Animal Husbandry (8th Eds.). Oxford and IBH Publishing Co.Pvt. Ltd.

Bartali, H. 1999. CIGR. Hand Book of Agricultural Engineering. Vol. II. Americal Society of Agricultural Engineers.

Collier, R.J & J.L. Collier. 2012. Environmental Physiology of Livestock. John Wiley & Sons. Inc. DOI. 10.1002/9781119949091.

FAO. 1999. Farmers Hand Book on Pig Production (for the small holders at village level), FAO,

Joshi, B.R. & B.S. Shrestha. 2003. The Goats their Production and Health Management (Ist Ed). Agricultural Research Station, Kashki, Pokhara, GoN, Nepal.

NAS. 2001/ National Academy of Science. Nutrient Requirements of Dairy Cattle (7^{th} Eds.). Sub-Committee on Dairy Cattle Nutrition, National Res earch Council, Washington DC.

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Upreti, C.R.., B.P. Kushbuwa and S. Upreti. 2012. Cattle and Buffalo Husbandry Technology, Nepal. Agriculture Research Council, Khumaltar, Lalitpur, Nepal.

Course:	**Hrs. Theory : 64 Hrs. Practical : 64**
Unit:1 Introduction to the housing management	**Hrs theory :**
Objectives	Contents
• Define the concept and terminology • Provide knowledge on housing systems and related details	Concept of housing management Factors related to housing management Common housing systems of major livestock species System knowledge on housing management and provisions
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 2. Cattle/buffalo housing	**Hrs theory :**
Objectives	Contents

• Explain common housing systems of cattle and buffaloes • Provide basic knowledge on cattle and buffalo housing system	Types of housing Loose house barn and other provisions Cattle shed Buffalo shed Shed for calves Advantage of tail to tail and face to face system
Evaluation Methods: Oral and written tests, assignment; classroom discussion and evaluation	**Teaching /Learning activities and resources:** Classroom instruction, illustration, diagrams, visuals, textbooks, and reference books
Unit: 3. Other details of cattle/buffalo housing	**Hrs Theory**
Objectives	Contents
• To provide basic information on floor, manger and alleys management of cattle/buffalo housing	Floor requirements Walls and roof conditions Stall design The stanchion stall; tie stall Manger, alleys and requirements Manger gutter Calving boxes and isolation boxes Shed for young stocks Bull or bullock shed
Evaluation Methods: Oral and written tests, assignment; classroom discussion and evaluation	**Teaching /Learning activities and resources:** Classroom instruction, illustration, diagrams, visuals, textbooks, and reference books.

Unit: 4. Housing of goats	**Hrs Theory**
Objectives	Contents
• To teach basic principle and practices of goat housing	Housing Shed orientation Shed dimension Roof, ventilation management Important consideration for construction of goat shed Disposal of the manure Shed for kids rearing
Evaluation Methods: Oral and written tests, assignment; classroom discussion and evaluation	**Teaching /Learning activities and resources:** Classroom instruction, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 5. Sheep housing	**Hrs Theory**
Objectives	Contents
• To teach basic principle and practices of sheep housing	Types of housing Scale of rearing and housing determinants Semi-open; grazing provision Extensive-confined Extensive-confined with housing overnight Intensive-confined Young one care and housing management
Evaluation Methods: Oral and written tests, assignment; classroom	**Teaching /Learning activities and resources:** Classroom instruction, illustration, diagrams,

discussion and evaluation	visuals, textbooks, and reference books.
Unit: 6. Pig housing	**Hrs Theory**
Objectives	Contents
• To teach basic principle and practices of pig housing	Types of pig holding and scale of rearing Selection of housing locations Construction plan for a good pig house/shed Space requirements for different purpose of pig rearing Different models/types of pig house/shed Housing arrangement for new born and growing one
Evaluation Methods: Oral and written tests, assignment; classroom discussion and evaluation	**Teaching /Learning activities and resources:** Classroom instruction, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 7. Climate influence on livestock productivity	**Hrs Theory**
Objectives	Contents
• To provide basic knowledge on livestock rearing and environmental concern	Climate influence on livestock productivity Environmental effects and energy requirements Heat stress, ambient temperature, Relative Humidity, radiant energy and wind speed
Evaluation Methods: Oral and written tests, assignment; classroom	**Teaching /Learning activities and resources:** Classroom instruction, illustration, diagrams,

discussion and evaluation	visuals, textbooks, and reference books.
Unit: 8. Livestock and climate change	**Hrs Theory**
Objectives	Contents
• To provide common knowledge and concern about livestock in relation to the climate change	Introduction about climate change Segments of atmosphere Methane gas generation and adaptive measures Emission of methane gas from dung and manure Adaptation techniques of methane gas and management
Evaluation Methods: Oral and written tests, assignment; classroom discussion and evaluation	**Teaching /Learning activities and resources:** Classroom instruction, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 9. Environment and animal well-being.	**Hrs Theory**
Objectives	Contents
• To provide common knowledge about animal wel being in relation to the environmental concerns	Introduction about the topic Animal well-being and stress management Well-being audits include measures of environment Animal welfare and proper handling
Evaluation Methods: Oral and written tests, assignment; classroom	**Teaching /Learning activities and resources:** Classroom instruction, illustration, diagrams,

discussion and evaluation	visuals, textbooks, and reference books.
Unit: 10. Strategies to reduce the impact of heat and cold stress	**Hrs Theory**
Objectives	Contents
• To make aware about stress in livestock rearing and to teach strategies to handle them	Importance of shade in stress management Water availability and management Cooling the milk centre Reducing heat and cold stress in different types of housing Cold stress and warming effect Monitoring heat stress on commercial dairies
Evaluation Methods: Oral and written tests, assignment; classroom discussion and evaluation	**Teaching /Learning activities and resources:** Classroom instruction, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 11. Effect of environment on animal health, immune and metabolism	**Hrs Theory**
Objectives	Contents
• To provide general information on livestock health and immune system in relation to the rearing environment	The issue of environment-health interactions Thermodynamics and the biology of rearing Environmental parameters and their effects on immune function Mechanism of interactions between environmental features and immune functions Metabolic adaptation to reduce feed intake Effect of heat stress on aspects of endocrine

	system Coordinated metabolic consequences of heat stress Potential reasons for heat- induced metabolic shifts
Evaluation Methods: Oral and written tests, assignment; classroom discussion and evaluation	**Teaching /Learning activities and resources:** Classroom instruction, illustration, diagrams, visuals, textbooks, and reference books.

Animal Housing and Environmental Science Practical

Animal Housing and Environmental Science Practical	**Hrs Practical : 64 hrs**
Practical 1: Introduction to the concept of dairy housing	**Hrs :**
Objectives	Contents
• Provide pertinent knowledge on dairy housing • Explore dairy housing knowledge based system	Theoretical orientation of the concept Demonstrate models and fact sheet on housing Specimens, photographs and visuals
Practical 2: Practices on dairy cattle/buffalo housing designing	**Hrs :**
Objectives	Contents

• Provide basic information on the lay-out and design of dairy cattle and buffalo housing	Theoretical orientation Sample of housing design/specimen Requirements Designing Drawing houses with different dimensions and requirements
Practical 3: Practices on sheep and goat housing designing	**Hrs :**
Objectives	Contents
• Provide basic information on the lay-out and design of dairy cattle and buffalo housing	Theoretical orientation Sample of housing design/specimen Requirements Designing Drawing houses with different dimensions and requirements
Practical 4: Practices on pig housing designing	**Hrs :**
Objectives	Contents
• Provide basic information on the lay-out and design of dairy cattle and buffalo housing	Theoretical orientation Sample of housing design/specimen Requirements Designing Drawing houses with different dimensions
Practical 5: Exploration of livestock housing	**Hrs :**

and environmental issues	
Objectives	Contents
• To provide basic information on environmental issues in relation to livestock housing considering stress management and livestock well-being	Theoretical orientations Class-room practice (talk, discussion) about environmental issues and livestock rearing Photographs study Videos and related information display Discussion

Animal Health I

Total hours: 3+1 :160 hours **Full Marks: 100**

Theory: 96 hours

Practical: 64 hours

Course Description

Gross anatomy of skeletal, digestive, respiratory, circulatory, reproductive, urinary, nervous, endocrine and sensory system, Functions of different systems of livestock and poultry, Reproductive hormones and their functions, Organisms causing infectious diseases: bacteria, virus and fungus, Helminths, common external and internal parasites, common protozoa, Administration of drugs, Factors affecting drugs, Prescription writing, Poisoning,

Inflammatory status of stomach, intestine, liver, kidney, lung, heart and mammary gland.

History taking and clinical examinations, Diagnosis and treatment of common diseases of digestive, respiratory, excretory, nervous , sensory and integumentry system, Wound, injury, fracture, Anoestrous, prolapse,and dystocia.

Course Objectives

This Course has the following Objectives:

- Study of gross structure of different system of body
- Understand physiology of digestion, absorption, reproduction and excreation
- Demonstrate morphology and colony characteristics of bacteria
- Assess the knowledge about Helminths parasites
- Understand drug acting on various body systems and prescription writing
- Diagnosis and treatment of common diseases of digestive, respiratory , excretory, nervous , sensory and integumentry system
- Familier with general surgical conditions
- Identify the diseases during gestation period

Minimum Standards

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

Text and Reference books

Blood, D.C. and O.M. Radostits. A Text Book of the Disease of cattle, sheep, pig, goat

and horses. ELBS Publication

Chakrabarti, Amlendu. A Text Book of Clinical Veterinary medicine.

Course:	**Hrs. Theory :** **Hrs. Practical :**
Unit: 1 Anatomy of domestic animals	**Hrs theory : 10**
Objectives	Contents
• Classify tissues • Study of gross structure of different system of body	• Different tissues of animal body • Gross anatomy of skeletal, digestive, respiratory, circulatory, reproductive, urinary, nervous, endocrine and sensory system
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 2 Physiology of domesticated animals	**Hrs theory : 8**
Objectives	Contents
• Understand physiology of digestion and absorption • Physiology of reproduction and excreation • Familier with role of hormones	• Animal cell: structure and functions • Functions of different systems of livestock and poultry • Reproductive hormones and their functions
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:**

	Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 3 Microbiology	**Hrs Theory: 6**
Objectives	Contents
• Understand morphology and colony characteristics of bacteria and virus • Assess the knowledge on immunization	• Organisms causing infectious diseases: bacteria, virus and fungus. • Differentiate between bacteria and virus • Immunity and immunization (vaccination)
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 4 Parasitology	**Hrs theory :10**
Objectives	Contents
• Assess the knowledge about Helminths parasites • Recognize common internal and external parasites • Understand common protozoa of livestock	• Helminthes: trematodes, nematodes and cestodes • Common internal parasites and their characteristics • Common external parasites and their characteristics • Common protozoa and their characteristics
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 5 Pharmacology	**Hrs theory :12**
Objectives	Contents
• Understand drug acting on various body systems • Recognize the factors affecting dosage of the drugs	• Route of drugs/medicines administration • Antibiotics, anthelmintics, purgatives, antihistaminics, analgesics and anaesthetic drugs. • Factors affecting dosage of drugs • Calculating dosage of drugs

• Toxicology of the various drugs	• Prescription writing • Poisoning: cyanide, nitrate, organophosphate, snake bite • Preparation of tincture, lotion, ointment and mixtures
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 6 Pathology	**Hrs Theory : 7**
Objectives	Contents
• Able to demonstrate normal and abnormal structures. • Understand the pathology of certain diseases with the help of gross lesions	• Inflammatory status of stomach, intestine, liver, kidney, lung, heart and mammary gland
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 7 Internal Medicine	**Hrs theory : 12**
Objectives	Contents
• Examination of sick animals • Diagnosis and treatment of common diseases of digestive, respiratory , excretory, nervous , sensory and integumentry system	• Sign of health and disease • Classification of disease • History taking and clinical examination • Tympany, impaction, diarrhea and dysentery • Epistaxis and pneumonia • Anaemia • Nephritis and retention of urine • Encephalitis • Conjunctivitis and ootitis • Dermatitis
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.

Unit: 8 Surgical affections	**Hrs theory : 4**
Objectives	Contents
• Familier with general surgical conditions • Diagnose and correct fracture	• Wounds/injuries • Burns • Dislocation and fracture
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 9 Reproductive problems	**Hrs Theory : 6**
Objectives	Contents
• Understand pathological conditions of reproductive system • Identify the diseases during gestation period	• Infertility /anoestrous • Metritis and retention of placenta • Prolapse • Dystocia
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.

Animal Health I Practicals

Animal Health I Practical	**Hrs Practical :**
Practical 1: Dissection and study of entire body system in livestock and poultry	**Hrs : 2**
Objectives	Contents

• Understand gross structure of bone, muscles and joints • Identify visceral organs of the body	• Male and female animals and birds • Gross study of bone, muscle and joints • Visceral organs
Practical 2: Blood collection and preparation of smears	**Hrs :2**
Objectives	Contents
• Demonstrate staining techniques and recognition of white blood cells	• Blood • Anticoagulants • Structure of blood cells- charts
Practical 3: Sterilization of glassware	**Hrs : 1**
Objectives	Contents
• Demonstrate sterilization of glassware	• Glassware such as Petridishes, flasks, measuring cylinder, test tubes etc.
Practical 4: preparation of common laboratory medias	**Hrs :2**
Objectives	Contents
• Demonstrate media preparation and culture of the milk samples	• Culture medias – Himedia, Nutrient agar, Mac Conky agar etc.
Practical 5: Study of bacteria	**Hrs : 1**
Objectives	Contents
• Demonstrate bacteria using Gram's method of staining	• Bacterial culture • Gram's stain • Acetone • Gram's iodine • Safranine
Practical 6: Study of parasitic eggs	**Hrs : 2**
Objectives	Contents

• Recognize the eggs of common Trematodes and Nematodes	• Examination of faecal samples
Practical 7: Preparation of ointments and lotions	**Hrs : 2**
Objectives	Contents
• Preparation of ointments and lotions • Familier with dosage of the drugs	• Prescription writing methods • Calculation of dosage of drugs • Tincture iodine and Lugol's iodine • Preparation of common ointments
Practical 8: Route of administration of drugs	**Hrs : 2**
Objectives	Contents
• Practice of administration of the drugs	• IV infusion set • Antibiotics • Livertonic injections • Bolus / tablets • Syringe and needle

Practical 9 : Route of administration of vaccines	**Hrs : 2**
Objectives	Contents
• Understand site for administration of biological	• Common vaccines
Practical 10: History taking and clinical examination of patient	**Hrs : 2**
Objectives	Contents
• Practice of History taking • Clinical examination of patient	• Livestock farm • History taking and general appearance • Sick animals

Practical 11: Physical examination: Temperature, pulse, respiration, palpation, percussion and auscultation	**Hrs : 2**
Objectives	Contents
• Practice of handling and physical examination of patient	• Livestock farm • Organizing Health camps
Practical 12: Examination of wounds and it's treatment	**Hrs :1**
Objectives	Contents
• Practice of dressing of wounds • Exposure in surgical case	• Animals having wound • Dressing materials
Practical 13: Identification of female genital organs	**Hrs : 1**
Objectives	Contents
• Handling and recognition of female genital organs	• Collection of genital organs from slaughter houses
Practical 14: Rectal palpation of animals	**Hrs : 1**
Objectives	Contents
• Practicing rectal palpation in dairy cows and buffaloes	• Livestock farm • Organizing infertility camps or health camps

Sheep, Goat and Swine Production

Credit hours: (2+1)/week **Full Marks: 100**

Total hours: 128

Theory: 64

Practical: 64

Course Description:

This course will Provides basic skills and knowledge of sheep and goat farming including breeds, breeding, feeding, housing, care, health, sanitation and marketing of sheep, goat and their products.

Course Objectives:

Upon Completion of course, the students will be able to;

- explain the importance , scope and limitation of sheep and goat farming in Nepal.
- Know about different breeds and explain their distinguishing characteristics.
- Select size and describe house and system of housing.
- explain feeds and feeding of sheep and goats.
- manage new born kids/lamb, pregnant, lactating doe/buck, breeding male and replacement stock.
- explain selection, breeding management of sheep/goat.
- perform restraining, castration, dipping, record keeping etc.
- provide preventive health care of sheep/ goat.
- market live animals and their products.

Minimum standards

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

Text and Reference books :

- The goats, their production and health management, Dr.BR Joshi and B.S. Shrestha.
- Goat sheep and pig production and management, Jagadish Prasad.
- Livestock production and management, NSR Sastri, CK Thomas and RA singh.
- Sheep and goat disease, P.D. Mathur and Dahly.
- Text book of quality meat production, SK Ranjhan.
- Text book of meat inspection, Horace Thortan.

Course : Sheep, Goat and Swine Production	Hrs, Theory :64 hrs Hrs, Practical : 64 hrs
Unit-1	Hrs Theory ;
Objectives	Contents
Explain importance, scope and limitation of sheep/goat farming in Nepal	- History of sheep/goat farming in Nepal. - Importance, scope, limitation and suggested measures of sheep/goat farming in Nepal. - Distribution and their contribution to the GDP in Nepal.
Unit-2	Hrs Theory
Objectives	Contents
Identify external body parts of sheep/goat	- Objectives: To know the external body parts of sheep and goat. - Identification of body parts of sheep/goat with the help of live animal and well labelled diagram.
Classify sheep/goat Zoologically	- Define : Taxonomy, Nomenclature of animal - Zoological classification of sheep/goat.
Unit-3	Hrs Theory :
Objectives	Contents

Identify breeds of sheep/goat	- Characterstics of Indigenous/local breeds of goat (Khari, Terai, sinhal, chyangra). - Characteristics of Exotic/improved breeds of goat (Jamunapari, Barberi, Black Bengal, Saanen Toggen berg, Anglo-Nubin and Boer). - Characteristics of Indigenous Sheep (Kage, Baruwal, Lampuchhre, Dhorel, Bhyanglung). - Characteristics of Exotic breeds of sheep (Merino, Ramboullet, Border Leicester, Lincoln).
Unit-4	Hrs : Theory
Objective	Contents
Select the site for housing of sheep/goat	- Objective and importance of site selection factor affecting for site selection. - orientation of house in different topographical region.
Explain housing system for sheep and goat	- Definition of housing. - Importance of housing - Types and system of housing.
Arrange space requirement for sheep and goat.	- space requirement for pregnant, lambing/kidding pen. - space requirement for young kids/lamb after weaning. - space requirement for breeding male. - space requirement for replacement stock. - space requirement for store room, shearing pen.etc
Unit-5	Hrs : Theory
Objectives	Content

Provide feed for sheep/goat	- Importance of feeding. - Routine feeding schedule. - Quantity and quality of feed/day/time. - feeding methods. - Utilization of feed and water. - Requirement of feed for different aged/ categories of sheep/goat.
Feed fooder for sheep/goat	- List of fooder (leguminous and Non-leguminous) - Requirement of fooder to sheep/goat - Importance of fooder for sheep/goat.
Make hay rack from local materials	- Introduction, importance of hay rack - Types of hay rack - Size and height of hay rack.
Prepare urea molasses mineral block	- Importance of UMMB. - Material required for making UMMB. - Preparatin of UMMB.
Unit-6	Hrs: Theory
Objectives	Contents
Arrange breeding management for sheep/goat.	- Introduction, importance of breeding. - Reproductive organs of male and female. - Spermatogenesis, oogenesis, ovulation and fertilization. - Sexual maturity of male and female. - Sesonality effects on mating. - Methods of breeding.
Select breeding male and female	- Importance of selection. - methods of selection. - selection criteria male and female for breeding.
Arrange breeding plan for sheep and goat	- Breeding plan for avoiding inbreeding in sheep/goat. - Breeding plan for genetic improvement of sheep/goat.

Detect heat by external symptoms	- Importance of heat detection. - Heat/esturs cycle. - Age of puberty. - Sign and symptoms of heat in sheep/goat.
Score conditioning of sheep/goat	- importance of scoring - method of scoring , judging of sheep/goat.
Unit-7	Hrs: Theory
Objectives	Contents
Provide care for new born kid/lamb	- Removal of mucus. - Removal of naval cord. - Assisting for walking and suckling of colostrums. - Importance of colostrum feeding - Orphan management (if needed).
Provide care for pregnant doe/ewe	- Feeding management of pregnant. - Housing (Fioor space of pregnant pen) requirement and sanitation requirement. - Pregnancy diagnosis. - Maintaining health record. - Provision of bedding materials. - Precaution to be taken during parturition.
Provide care during parturition	- sign or symptoms before parturition. - Cleaning and disifection of parturition pen before and after parturition. - Assisting during parturition. - provision of bedding materials. - precaution to be taken during parturition.
Provide care for breeding buck/Ram	- feeding management. - Housing Management. - space requirement. - sanitation and health care. - Drenching against parasites. - provision of exercise during inactive period.
Unit-8	Hrs: Theory
Objectives	Contents

Provide preventive health care	- Common external and internal parasites of sheep and goats, and their control measures. - Common diseases of sheep and goat and their preventive measures. - Vaccination schedules for sheep/goat.
Arrange sanitation for hygienic environment	- Importance of sanitation. - Collection and disposal of manure and bedding materials. - Cleaning and disinfections of shed/barn. - Factor affecting sanitation of barn. - Good characteristics of disinfectants.
Unit-9	Hrs: Theory
Objectives	Contents
Restrain sheep/goat	- Objectives, importance, principles of restraining. - Methods of restraining . - Precaution to be taken while restraining.
Identify sheep/goat	- objectives, importance, principles of identification. - methods of identification (Tagging, Tattoing of sheep and goat. - Tools used for identification. - Temporary methods of identification. - Precaution to be taken for identification.
Castrate buck/Ram	- Introduction, importance and methods of castration. - proper age of castration. - precaution to be taken.
Shear sheep	- Objectives, Introduction of shearing of sheep. - Bathing/cleaning of sheep before shearing. - Appropriate season for shearing. - Important point should be considered before shearing.
dip sheep/goat	- Importance and objectives of dipping. - Types of dipping tank (size and shape) - use of chemicals to control ecto-parasites. - precautions to be taken prior to shearing.

Calculate Av. live body wt. by measuring body parts of sheep/goat	- Importance of weight measuring. - Calculation of Av. body wt. by using formulae - Precaution to be taken.
Cut/trim Hoof of sheep/goat	- Importance of hoof cutting/trimming - Methods of hoof trimming, precaution to be taken.
Keep record of sheep/goat	- Importance of record keeping types of sheep/goat (farm) records. - (Breeding, feeding, health, production etc records).
Unit-10	Hrs: Theory
Objectives	Contents
Slaughter sheep/goat	- Introduction. - Methods of slaughtering. - Types and quality of good carcass. - Precautions to be taken during slaughtering.
Sale products	- Preparation of marketable products. - Channel of marketing. - Demand of consumers. - Processing techniques. - Importance of billing.
Evaluation methods : oral and written assignment	- Teaching learning activities and resources : class room, instruction, observation, illustration diagram, visual, text books, reference books.

Sheep and Goat Production Practical

Sheep and Goat Production Practical	**Hrs Practical : 64 hrs**
Practical 1: External body parts	**Hrs :**
Objectives	Contents

Identify external body parts of sheep and goat.	Live sheep and goat. Well labeled diagram of external body parts of sheep and goat.
Practical 2: Breeds Identification.	**Hrs :**
Objectives	Contents
Identify breeds of sheep and goat. Know the distinguishing characteristics of sheep and goat.	Observe different exotic and indigenous breeds of sheep and goat (available in the farm).
Practical 3: Identification/Marking/Numbering	**Hrs :**
Objectives	Contents
Perform identification/mark on sheep and goat.	Methods of identification (Tagging and Tattoing) Tools used for identification Proper age of identification Precautions to be taken
Practical 4: Housing	**Hrs :**
Objectives	Contents
Housing of sheep and goat.	Types of housing Orientations of housing Space requirements of different aged/stages of sheep and goat.
Practical 5: Restraning/Handling	**Hrs :**
Objectives	Contents
Restrain sheep and goat.	Methods of restraining. Restrain different aged/stages of sheep and goat.

	Precautions to be taken.
Practical 6: Castration	**Hrs :**
Objectives	Contents
Castrate buck/ram.	Principle & Methods of castration. Proper age of castration. Precautions to be taken.
Practical 7: Body weight calculation	**Hrs :**
Objectives	Contents
Calculate live weight by measuring	Principles and methods of weighing. Calculation of average body weight by using formulae. Precaution to be taken.
Practical 8: Dipping	**Hrs :**
Objectives	Contents
Dip sheep and goat.	Principle and types of dipping (size and shape). Use of chemicals to control ecto-parasites. Precautions to be taken.
Practical 9: Shearing	**Hrs :**
Objectives	Contents
Shear sheep.	Principle of shearing, bathing of sheep before shearing. Season for shearing Precaution to be taken prior to shearing.
Practical 10: Trimming	**Hrs :**

Objectives	Contents
Cut/ trimming hoof of sheep and goat	Principle and methods of hoof trimming. Precautions to be taken.
Practical 11: Record keeping	**Hrs :**
Objectives	Contents
Keep records Know the importance of record keeping.	Principle and types of farm records (breeding, feeding, health and production).
Practical 12: Feeds and Fodders	**Hrs :**
Objectives	Contents
Provide feeds and fodders. Identify feeds and fodders.	Principle of feeding. List of fodders. Requirement of fodder for sheep and goat.
Practical 13: Construction of Hay racks.	**Hrs :**
Objectives	Contents
Make hay racks from local materials.	Types of hay racks. Size and height of hay racks.
Practical 14: UMMB	**Hrs :**
Objectives	Contents
Prepare UMMB Feeding of UMMB	Materials required for UMMB.
Practical 15: Scoring	**Hrs :**
Objectives	Contents
Scoring of sheep and goat	Principle and methods of scoring. Judging of sheep and goat for meat, milk and wool/fibres.

Third Year

Commercial Dairy Farming

Animal Health ll

Dairy and Animal Product Technology

Poultry Entrepreneurship

Veterinary Laboratory Techniques

Animal Breeding and Artificial Insemination

Equine, Rabbit and Pet Animals

Veterinary Clinic Practices

Work Experience Program (WEP)

Commercial Dairy Farming

Credit hours: (3+1)/week **Full Marks: 100**

Total hours: 160

Theory: 96

Practical: 64

Course Description

This course provides basic knowledge in dairy animals (cattle and buffalo) including the common terminologies, their housing , feeding , breeding management and other general daily farm operation and prevention and treatment for major disease problems.

Course Objectives

This Course has the following Objectives:

- Provide basic information about commercial dairy farming in Nepal
- Explain characteristics of common milch breeds of cattle and buffalo
- Demonstrate the techniques for improved livestock management practices.
- Demonstrate the method of feeding, breeding and rearing farm animals
- Establish livestock farm with minimum guidance of experts
- Generate ideas of self employment by dairy animal farming
- Work as a middle level technician in dairy farm
- Provide technical service to private and government farms

Minimum Standards

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

Books and references:

1. Banerjee, G.C.1991. A Text Book of Animal Husbandry (7^{th} ed). Oxford and IBH Publishing Co.,
2. Prasad, J. 1997. Animal Husbandry and dairy Science. Kalyani Publishers
3. Sastry, N.S.R., C.K. Thomas and R.A. Singh. Livestock Production and Management(3^{rd}ed),Kalyani Publishers

4. Ranjhan, C K., and N. N. Pathak. Text book of buffalo production. Vikas Publishing House , New Delhi

Course:	
Unit- 1 Introduction to commercial dairy animal farming in Nepal	**Hrs theory : 10**
Objectives	Contents
• Introduce dairy animals • Explain scope of dairy farming in Nepal • Explain history, present status, problem, prospect and strategy of commercial dairy animal farming in Nepal • Explain role of dairy industries in dairy animal farming • Explain role dairy of cooperative in commercial dairy animal farming	Introduction of cattle and buffalos species and their zoological distribution Terminology of animal husbandry Present status, problem, prospect and government policy and strategy of commercialization of dairy animal farming in Nepal Introduction of private and government dairy industries and their role in the establishment of commercial dairy farms in Nepal Dairy cooperative in Nepal
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit-2 Cattle and buffalo breeds	**Hrs theory : 6**
Objectives	Contents
• Explain characteristics of exotic and /improved breeds of cattle and buffaloes with their importance • Explain characteristics of Nepali and Indian breeds of cattle with their importance	Major milch and other breeds of cattle and buffalo worldwide Major cattle and buffalo breeds in Nepal and India and their genetic performance
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. Housing management for commercial dairying	**Hrs Theory 10**
Objectives	Contents
• Explain and design cattle and buffalo housing	Housing for cattle and buffalo- different types of housing for small(less than 50), medium(50 to 100) and large scale (more than 100 milking animals) dairy farms; Tie stall and loose housing system, Space requirements for different age and stages Use of locally available materials for housing
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. Feeding management	**Hrs Theory 10**
Objectives	Contents
• Explain feeding of cows and buffalo	Feeding of cattle and buffalo- daily feed allowances, fodder based dairy farming for profitable dairying, Introduction of feeds and fodder for milking and replacement stock. Techniques of TMR(total mixed ration) preparation techniques
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 5 Daily care and management	**Hrs Theory 8**
Objectives	Contents
Practice daily care and management of large ruminants	Feeding animal for maintenance and production Care and management of pregnant and lactating animals

	Care and management of newly born calf Rearing of calf Management of breeding bull Care of diseased and sick animal Sanitation of dairy barn and equipment
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 6 Mechanisms of large ruminants reproduction	**Hrs Theory 8**
Objectives	Contents
• Identify male reproductive organs and their functions • Identify female reproductive organs and their functions • Explain hormones and their role in female reproductive mechanism • Explain the sexual cycle • Detection of heat, ovulation and fertilization	Male reproductive organs and their functions Female reproductive organs and their functions Hormones and their role in female reproductive mechanism The sexual cycle; detection of heat, ovulation and fertilization
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 Animal breeding and artificial insemination	**Hrs Theory 10**
Objectives	Contents
• Select animal and traits of selection • Explain systems of breeding • Explain selection methods • Explain artificial insemination and its advantages • Explain hormonal control of reproduction, fertilization and gestation period • Collect, examine and evaluate semen (including dilution, and storing) • Explain semen morphology and	Selection of animal and traits of selection Systems of breeding Selection methods Artificial insemination and its advantages Hormonal control of reproduction, fertilization and gestation period

abnormalities • Explain insemination techniques • Semen collection center, AI station and semen banks	Collection, examination and evaluation of semen (including dilution, and storing) Semen morphology and abnormalities Insemination techniques Semen collection center, AI station and semen banks
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 Mammary gland and lactation	**Hrs Theory 4**
Objectives	Contents
• Anatomy of mammary gland • Lactation, hormonal regulation, milk secretion and let down • Milk and its composition • Milking of cow and buffalo	Anatomy of mammary gland Lactation, hormonal regulation, milk secretion and let down Milk and its composition Milking of cow and buffalo
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 Weighing and identification of animal	**Hrs theory 3**
Objectives	Contents
Weigh and identify of animal	Weigh and identification of dairy animal
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 Debudding, dehorning, ducking, and castration	**Hrs theory 4**
Objectives	Contents
• Perform debudding, dehorning, docking, and castration	Perform debudding, dehorning, docking, and

	castration
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 Common ecto and endo parasites of large ruminants	**Hrs theory 4**
Objectives	Contents
Explain common ecto and endo parasites of large ruminants	Common ecto and endo parasites of large ruminants
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 12 Prevention and treatment of major diseases of large ruminants	**Hrs theory 10**
Objectives	Contents
• Explain the major health problems of cattle and buffalo	Major health problems of cattle and buffalo
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 Selection of animal	**Hrs Theory 3**
Objective	Content
Select animal for better performance	Selection of animal: Types , purpose, criteria and use of different scoring methods

Practicals:

Practicals	**Hrs Practical : 30**
Practical 1: Identification of common breeds of cattle and buffalo	**Hrs : 2**
Objectives	Contents
Identify common breeds of cattle, buffalo,	Common breeds of cattle, buffalo, goat, sheep, and poultry birds
Practical 2: Study on digestive system of ruminants	**Hrs 2**
Objectives	Contents
Acquire the practical knowledge of digestive system of ruminants	Digestive system of ruminants
Practical 3: Ageing of large ruminants	**Hrs 2**
Objectives	Contents
Perform ageing of large ruminants	Ageing of large ruminants
Practical 4: Study on reproductive systems of male and female ruminants	**Hrs 2**
Objectives	Contents
Introduce reproductive systems of male and female animals and poultry birds	Reproductive systems of male and female animals and poultry birds
Practical 5: Identification of large ruminants	**Hrs 2**
Objectives	Contents
Identify farm animals and poultry birds	Identification techniques of farm animals (tagging, tattoing, branding)
Practical 6: Treating cattle and buffalo against external and internal parasites and worms	**Hrs 4**
Objectives	Contents
Treat animals against external and internal parasites	Treatment of animals against external and internal parasites

Practical 7 : Practice on routine farm operations: weighing, debudding, dishorning, docking and castration	**Hrs 4**
Objectives	Contents
Practice routine farm operations: weighing, debudding, dishorning, docking and castration	Routine farm operations: weighing, debudding, dishorning, docking and castration
Practical 8 : Identification of common grasses and forage legumes	**Hrs 2**
Objectives	Contents
Identify common grasses and forage legumes	Identification of common grasses and forage legumes
Practical 9 : Judging animals for selection using different scoring methods	**Hrs 2**
Objectives	Contents
Judge animals for selection using different scoring methods	Judgment of animals for selection using different scoring methods
Practical 10: Feed formulation	**Hrs 4**
Objectives	Contents
Formulate ration using thumb's rules	Formulate ration using thumb's rules
Practical 11: Record keeping practices for farm animals	
Objectives	Contents
Keep record of farm animals	Record keeping practices for farm animals
Practical 12: Visit DLSO to observe and experience about Artificial Insemination	**Hr 4**
Objectives	Contents
Visit DLSO to observe and experience about Artificial Insemination practices.	Visit DLSO to observe and experience about Artificial Insemination practices.

Animal Health II

Credit hours: 3+1: hours **Full Marks: 100**

Total hours: 160

Theory: 96 hours

Practical: 64 hours

Course Description

Common bacterial diseases of livestock and poultry their treatment and control, Common viral diseases of livestock and poultry and their prevention, Diagnose and treat Fungal diseases of livestock, External and internal parasitic diseases , their treatment and control, Protozoan diseases and their treatment. Metabolic diseases of livestock and their treatment, Vitamins and mineral deficiency diseases and their management, Zoonotic diseases and their control, Semen collection, evaluation and AI.

Course Objectives

This Course has the following Objectives:

- Assess the status of bacterial diseases of livestock and poultry
- Diagnose and treat common bacterial diseases of livestock and poultry
- Evaluate the occurrence of common viral diseases of livestock and poultry
- Identify the techniques for the control of viral diseases of livestock and poultry
- Assess the status of fungal diseases of livestock
- Diagnose and treat common fungal diseases of livestock
- Identification of external and internal parasites
- Diagnose and treat protozoan diseases.
- Assess the status of Metabolic diseases of livestock
- Assess the role of different animals in the transmission of Zoonotic diseases and it's prevention
- Acquire knowledge on semen collection, evaluation,and AI

Minimum Standards

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

Text and Reference books

Blood, D.C. and O.M. Radostits. A Text Book of the Disease of cattle, sheep, Pig, Goat

and Horses. ELBS Publication

Chakrabarti, Amlendu. A Text Book of Preventive Veterinary Medicine

Soulsby, E.J.L. Helminths, Anthropodes, and Protozoa of Domestic Animals. ELBS Publicaton

Course: Animal Health II	**Hrs. Theory : 96 Hrs. Practical : 64**
Unit 1. Bacterial diseases of livestock	**Hrs theory : 15**
Objectives	Contents
• Assess the status of bacterial diseases of livestock • Diagnose and treat common bacterial diseases of livestock	• Haemorrhagic septicaemia • Anthrax • Black Quarter • Mastitis • Tetanus • Brucellosis • Foot rot • Enterotoxaemia • Strangles • Glanders
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 2 : Bacterial disease of poultry	**Hrs theory : 5**
Objectives	Contents
• Assess the status of bacterial diseases of poultry • Diagnose and treat common bacterial diseases of poultry	• Pullorum • Chronic respiratory disease • Colibacillosis • Fowl typhoid
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 3: Viral diseases of livestock	**Hrs Theory : 9**
Objectives	Contents
• Evaluate the occurrence of common viral diseases of livestock • Identify the techniques for the control of viral diseases of livestock	• Rabies • Rinderpest • Foot and mouth disease (FMD) • Pestes petits ruminant (PPR) in goat • Swine fever • Canine distemper

Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 4: Viral disease of Poultry	**Hrs theory :7**
Objectives	Contents
• Evaluate the occurrence of common viral diseases of poultry • Identify the techniques for the control of viral diseases of poultry	• Ranikhet disease • Gumboro disease • Marek's disease • Infectious bronchitis • Fowl pox
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 5 : Fungal disease of poultry	**Hrs theory : 4**
Objectives	Contents
• Assess the status of fungal diseases of livestock • Diagnose and treat common fungal diseases of livestock	• Ring worm • Mycotoxicosis • Aspergillosis
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 6 : Disease caused by internal parasites	**Hrs Theory: 10**
Objectives	Contents
• Identification of trematodes, nematodes and cestodes • Diagnose and treat protozoan diseases.	• Liver fluke • Amphistomiasis • Round worm of ruminants – large and small • Round worm of pig and poultry • Gid

	• Babesiosis (red water disease) • Coccidiosis • Theileriosis
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 7 : Disease caused by external parasites	**Hrs theory : 5**
Objectives	Contents
• Recognize the important arthropods, lice, ticks and mites	• Lice • Ticks • Mites • Leaches
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 8: Metabolic diseases	**Hrs theory : 5**
Objectives	Contents
• Assess the status of Metabolic diseases of livestock	• Milk fever • Grass tetany • Ketosis • Visceral gout in poultry
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 9: Deficiency diseases	**Hrs Theory : 6**
Objectives	Contents
• Assess the status of vitamins and	• Rickets

minerals	• Vitamin deficiencies • Mineral deficiencies
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 10: Diseases of public health importances	**Hrs theory : 5**
Objectives	Contents
• Assess the role of different animals in the transmission of Zoonotic diseases • Describe the methods of prevention and control of zoonotic diseases	• Importance of zoonotic disease • Milk borne diseases • Meat borne diseases • Concept of one health
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 11: Artificial inseminations	**Hrs theory : 4**
Objectives	Contents
• Acquire knowledge on semen collection and evaluation, • Train the students on AI	• Importance and scope of AI • Advantages and disadvantages • Insemination technique
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.

Animal Health II Practicals

Practicals	**Hrs Practical :**
Practical 1: Preparation of CMT reagent and	**Hrs : 1**

examination of milk	
Objectives	Contents
• Diagnose mastitis by CMT	• CMT paddle • CMT reagent • Sodium lauryl sulphate • pH meter
Practical 2: Practice of sterilization of glasswares	**Hrs : 1**
Objectives	Contents
• Preparation of glassware for culture	• Glasswares such as petridishes, flasks, • Hot air oven, • Autoclave
Practical 3: Practice of media preparation	**Hrs : 2**
Objectives	Contents
• Practice of preparing common bacteriological medias	• Nutrient agar • Mc Conky's agar
Practical 4: Cultural examination of milk and Gram's staining	**Hrs : 3**
Objectives	Contents
• Assess the morphology and colony characteristics of bacteria	• Cultural Medias • Crystal violet • Gram's iodine • Acetone • Safranine
Practical 5: Vaccination practices in livestock and poultry	**Hrs :2**
Objectives	Contents
• Train the students to handle the	• Vaccines or biologicals

animals and vaccinate them	• Vaccinator
Practical 6: Identification of common internal parasites of cattle and buffaloes	**Hrs :2**
Objectives	Contents
• Demonstrate the common internal parasites of cattle and buffaloes	• Collection of parasites from slaughtering places
Practical 7: Identification of common internal parasites of sheep and goat	Hrs.: 1
Objectives	Contents
• Demonstrate the common internal parasites of sheep and goat	• Collection of parasites from slaughtering places
Practical 8: Identification of common internal parasites of poultry	**Hrs : 1**
Objectives	Contents
• Demonstrate the common internal parasites of poultry	• Collection of parasites from slaughtering places

Practical 9: Morphology of external parasites of livestock	**Hrs :1**
Objectives	Contents
• Identify the common external parasites of livestock	• Collection and examination of external parasites of livestock
Practical 10: Morphology of external parasites of poultry	**Hrs :1**

Objectives	Contents
• Identify the common external parasites of poultry	• Collection and examination of external parasites of poultry
Practical 11: Collection and examination of blood for the protozoa	**Hrs :2**
Objectives	Contents
• Identify the common protozoa from the blood	• Collection of whole blood • Leishman's stain
Practical 12: Examination of urine for ketone bodies	**Hrs :1**
Objectives	Contents
• To find out the occurrence of Ketosis using Rothera's tes	• Collection of urine • Reagents
Practical 13: Practice of rectal examination	**Hrs :2**
Objectives	Contents
• To identify the genital organs	• Genital organs brought from slaughter house
Practical 14: Practice of Artificial Insemination	**Hrs :3**
Objectives	Contents
• To know the techniques of Artificial insemination	• AI gun • Semen • Liquid Nitrogen
Practical 15: Pregnancy diagnosis	**Hrs :2**
Objectives	Contents
• Practice in diagnosing pregnant animals	• Farm animals, pregnant animals

Dairy and Dairy Product Technology

Credit hours: 2+1/week **Full Marks: 100**

Total hours: 128 hours

Theory: 64 hours

Practical: 64 hours

Course Description

Course Objectives: After completion of this course the student will be able to understand the importance of milk, situation of dairying in Nepal, the physiology of lactation, wholesome and hygienic milk and milk product production and their collection and marketing situation.

This Course has the following Objectives:

- explain the importance of dairying and milk and its product
- work in the national and private dairy sectors
- Will be able to understand the definition, composition, physicochemical properties and nutritional value of milk
- Study about the physiology of lactation and hormones related to it
- Can gain knowledge about milk quality and marketing of milk and milk products
- Will be able to understand the products of milk and methods of their preparation

Minimum Standards

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

Text and Reference books

References

1.Clarence, H.E., W.B. Combs and H. Macy. 1994. Milk and Milk Products. Tata

MacGraw-Hill Publishing Co., India

2.Jelen, P.V. and N. Sah. Laboratory Manual of Dairy Science

3.Mahanta, K.C. Hand book of Dairy Science

4.Prasad, J. 1997. Animal Husbandry and Dairy Science. Kalyani Publishers

5. Ray, N.K. and D.C. Sen. A Text Book of Practical Dairy Chemistry

6. Sukumar, De. 2000. Outlines of Dairy Technology. Oxford University Press, New Delhi

Unit- 1 Introduction	**Hrs theory : 4**
Objectives	Contents
• Understand the meaning and the scope of dairying in Nepal • Will have sound knowledge about the importance of milk and their products • The situation of milk and milk product demand and production at national level	Meaning, branches and scope Dairying situation in Nepal Demand and supply of milk and milk products in Nepal Importance and scope of milk and milk products
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit-2 Mammary system, milk letdown and hormones	**Hrs theory : 18**
Objectives	Contents
Will gain knowledge about the physiology of mammary gland development and its functions Factors influencing milk withdrawal and constituents Natural and synthetic hormones related to milking Metabolic causes influencing lactation	Physiology and functions of mammary gland, Hormones /related to Mammary gland development, Lactation, Involution and regeneration. Sources of milk constituents Factors affecting milk withdrawal Synthetic hormones related to milking process, Metabolic disorders affecting lactation in Bovine Sheep and goat
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. . Clean milk production	**Hrs Theory 5**
Objectives	Contents
Will know the comparative methods of machine and hand milking Milking order and requirements of clean milk production Sources of contamination and their remedies in market milk	Methods of milking: Comparative study of hand and machine milking ,Milking order Prerequisites of clean milk production Sources and remedies of contamination in market milk
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. Milk	**Hrs Theory 7**
Objectives	Contents
• Define milk, Learn all about the composition and nutritive value of milk and milk product • Will understand physico-chemical properties and factors affecting the composition • Will know the flavors and off-flavors of milk and their causes	Definition ,Composition of milk, Nutritive value of milk, Physico-chemical properties of milk, Factors affecting the composition of milk, Flavors and off-flavors in milk
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 5 Milk quality	**Hrs Theory 4**
Objectives	Contents
• Will have knowledge about the concept of quality milk and its characteristics and factors responsible for influencing quality of milk	Concept of milk quality, Characteristics of quality milk, Factors affecting milk quality

Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 6. Fluid milk	**Hrs Theory 18**
Objectives	Content
• Will gain knowledge about the concept of different process carried out in dairying • Can learn about processing methods of fluid milk • Will understand about cleaning of utensils and CIP	Concept of Straining,Filtration,Chilling,Storage,Transporting Classification, Toning, Standardizing Processing of milk (definition, objectives and methods) Pasteurization ,Homogenization, Emulsification, Sterilization Cleaning Milk utensil on farm, Milk plant line in place (CIP), Sanitizing utensil and equipment
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 7 Buying and collection of milk	**Hrs theory 18**
Objectives	Contents
• Will be able to select milk producers and collection methods • Will be able to carry out different types of test in collection center and in lab • Can identify different types of micro-organism and adultertration methods	Buying and collection from vendors and producers, Selection of producers from milk collection, Payment systems based on weight, volume, fat and SNF, Tests for fluid milk quality , Butter fat and SNF, Reduction tests

	Micro organisms common to Raw milk, Pasteurized milk, Milk products Specific gravity of milk, Adulteration of milk with water, Cream separation method Effect of heat treatment on milk quality
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 Product processing	**Hrs Theory 16**
Objectives	Contents
• Can learn the nutritive values of milk and concept of product processing • Can have the knowledge about the common products prepared from milk and methods of preparation • Can judge the legal standard of product as per Nepal standard • Can calculate the costing of the product and fix the price	Concept, Types of milk products, Nutritive values, Method of preparation Butter, Chhenna and paneer , Cheddar and Cottage Cheese, Condensed milk, Curd Ice-cream, Milk powder, Khuwa Costing of different dairy products Legal standardization of different dairy products 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.

Practicals

Practicals in Dairy and Dairy Tech	**Hrs Practical :**
Practical 1: : Study of commonly used dairy equipments	**Hrs :4**
Objectives	Contents

• Be acquainted with different dairy equipment	-Visit the dairy lab and processing plant -Observe the shape and structure of equipments -Understand the purpose and the uses of the equipment
Practical 2: Milk animal using hygienic techniques	**Hrs 8**
Objectives**:**	Contents
• Will be in position to prepare the animal, shed and equipments for clean milk production • Will acquire knowledge to prevent transmission of disease and mastitis • Will develop confidence in hand milking methods	-Will know the sources of contamination -Understand the process of hygienic technique - Clean shed, animal before milking
Practical 3: Sampling of milk	**Hrs 2**
Objectives	Contents
• Learn the process of sampling milk • Learn about the method of sampling in collection center and in tankers	-Taking the sample with help of sampler -Will involved himself taking sample from can or tanker (bulk) - Methods of sampling which represent whole milk
Practical 4: Estimation of fat by Gerber's Method	**Hrs 2**
Objectives	Contents
• Develop confidence in testing the fat content of milk, cream etc. by Gerber's method	-Principles behind fat separation will be understood -Role of acid and amyl alcohol known -Involve own self to find out the fat content of the sample
Practical 5: Estimation of specific gravity, SNF and Total solid	**Hrs 6**

Objectives	Contents
• Each student will carry out the job by himself to have confidence in detecting specific gravity, SNF and TS • Students will learn the process of finding out TS, SNF and specific gravity of milk	-Milk samples be given to find out specific gravity, SNF and TS - Formulae utilized to find out the above parameter -Importance of determining these traits known
Practical 6: Perform quality control tests for milk and milk products	**Hrs 6**
Objective	**Contents**
• Students will know the quality control tests like organoleptic, COB, MBR and SPC • They will develop confidence in procuring quality milk	-More number of bacteria present in milk will take less time to reduce the methylene blue color -Will feel the sourness of milk -Stale milk will clot on boiling indicating low grade milk - Will utilize microscope to find out total bacterial count
Practical 7: Identification of different dairy products produced in Nepal	**Hrs 6**
Objective	**Contents**
• The students will observe the common dairy products of Nepal • It will add extra knowledge about the varieties of milk products produced in Nepal and abroad • Will have gained knowledge about their uses in different purpose	-Students involved in observing varieties of products and methods employed to prepare them -They will also feel, taste the product for understanding their quality -Observe and judge through tasting, sneezing, texture, structure color, moisture content, smoothness or grittiness of the product.
Practical 8: Study of cream separator and method of cream separation	**Hrs 4**

Objective	**Contents**
• Will be familiar with the cream separator parts, their functions and principle behind cream separation • Will develop confidence in separating cream from whole milk	-Each parts dismantled and shown to the students briefing their role in cream separation -Demonstrate the parts by assembling before cream separation -Explained about the principle how cream get separated from milk -Students separate cream by using cream separator - Will analyze the fat content of the cream
Practical 9 : Standardization of milk and milk products	**Hrs 6**
Objective	**Contents**
Practical 10: Preparation of curd, khuwa, cheese, butter, ice cream, and ghee	**Hrs 12**
Objective	**Content**
• The students will develop confidence to prepare different products • They will understand different methods and ingredients and other materials utilized to prepare each products •	-Different culture used, ingredients calculated -Different and desirable equipments used as per requirement -Heat treatment carried out as required -Quality aspect judged through smell, taste, color, texture, smoothness or toughness - Packaged and stored in suitable temperature
Practical 11: Visit and observe nearby dairy processing plant	**Hrs 4**
Objective	**Content**
• Acquaint with fixtures, machinery and equipments requirements of dairy processing plant • Observe the milk receiving in plant,	-Students starting from milk unloading platform will continue to other major points

pasteurization, homogenization, fat separation, cleaning and sanitation process adopted • Different product preparation section and process of manufacture, packaging and storage and dispatch to the market	- The manager will demonstrate and explain all procedure of milk cream separation, homogenization, pasteurization to cooling, packaging and dispatch -Students get opportunity to see all other product manufacture section and process used -Will discuss about the cleaning, hygiene and sanitation process and the chemical used for this purpose

Poultry Entrepreneurship

Credit hours: 2+1/week **Full Marks: 100**

Total hours: 128 hours

Theory: 64 hours

Practical: 64 hours

Course Description

This course is designed to provide basic skills and knowledge of poultry farming including breeds of chicken, housing, care and manage of broiler and layer chicken for commercial farming and marketing of meat and eggs.

Course Objectives

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

1. describe the scope and importance of poultry farming in Nepal
2. explain different breeds of chicken
3. design poultry house for commercial farming
4. care/ manage chicks, grower and layers
5. care/ manage broiler chickens
6. explain poultry breeding
7. explain feeds and feeding of poultry
8. market meat and eggs

Minimum Standards

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

Text and Reference books

Poultry production, RA Singh

Course:	**Hrs. Theory :** **Hrs. Practical :**
Unit: 1 Introduction, scope, history, problem ,prospect and strategy of poultry farming in Nepal	**Hrs theory : 6**
Objectives	Contents
Explain scope of poultry production in Nepal Explain government policies for poultry farming/ hatchery industry	History of poultry production in Nepal Scope and importance of poultry farming Present status (statistics), problems and future prospect of

in Nepal Explain common terms used in poultry	poultry production in Nepal Government policies, norms, rules and regulation for poultry industry Government and private chicken hatcheries Terminology: Poultry, broiler, layer, pullet, capon, rooster, culling, moulting, starter, grower, finisher, cock, hen, chicks, geld etc
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 2 Chicken breeds	**Hrs theory : 4**
Objectives	Contents
Explain poultry breeds	Breeds of chicken: Asiatic (Brahma, Cohchin, Langsan), Meditarrian (Leghorn, Minorka), English (Austrolarp, Susex) and American breeds (Rode Island Red, New Hampshire, Plymouth Rock)of chicken Common hybrid layer (Hyline brown, Lomann, Isha brown, Hisex brown Babcob, Saver star cross 579) and broiler (Vencob, Cob 400, Cob 500, Hubard, Arboracre, Ross etc) breeds of chicken Nepali local chicken: Sakini, Ghati Khuile(nacked neck), Pwuankh Ulte(feather in opposite direction) and their meat quality, meat taste, broodiness and role in socio economic and cultural aspect aspct of rural people. Dual purpose hybrid chicken: Giriraj
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 3 External and internal body parts of chicken	**Hrs Theory: 3**
Objectives	Contents
Explain and identify external and internal body parts of chicken	External body parts of chicken Internal body parts of chicken: digestive, respiratory and reproductive system

Identify internal structure of a egg	Internal structure of eggs - Well labeled diagramof f resh egg, Nutrient composition of egg, Normal and abnormal eggs
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 4 Housing system of poultry	**Hrs theory :4**
Objectives	Contents
Explain housing system of poultry Explain deep litter housing system of poultry Select site for poultry farm construction Explain poultry shed construction	Housing system: Free range, semi intensive, intensive(cage ,deep litter); advantages and disadvantages of each system Floor space requirements in different age group Purpose of farming: Hatchery/ commercial Site selection: Topography,Availability of feeds/ medicine, Workers/ technician availability,Market accessibility, Water and electricity supply,Roads Availability of low cost construction materials Lay out diagram: Purpose of construction(hatchery, layer, broiler farm);Small farm , Large scale farm Construction materials: Sand, gravel, cement, GI sheet, stone/ brick, local roofing materials Area calculation on basis of no. of birds and type Litter management: Application of lime and bleaching powder Thickness of litter in summer and winter months
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 5 Poultry equipmets	**Hrs theory :12**

Objectives	Contents
• Identify poultry equipments dosage of the drugs	• Feeder, drinker, nest box, hover, perches, weighing balance, candler, debeaker, vaccinator, refrigerator, light source
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 6 Care and management of poultry birds	**Hrs Theory : 7**
Objectives	Contents
Prepare for brooding Care chicks (0-8 weeks) Care grower (8-18 weeks) Care laying chicken (18 weeks and above) Care and manage broilers	Installation of hover, height of brooder, chick guard, fitting light, temperature maintaining, litter placing, checking water sources, emergency light source, space calculation, proper ventilation , protection from chilling and air draft. Receiving chicks from reliable hatchery, maintaining bio-security, feeding chicks (L1 ration), incorporation of electrolytes, vitamin and antibiotics in feed or water in order to prevent early chick mortality, vaccination, record keeping(daily feed consumption, weight gain, medicine and vaccination, mortality) Bio-security measure, feeding pullet (L2 ration), feed restriction, reducing artificial light, moulting, debeaking, vaccination, vitamin and antibiotics supplement, record keeping Bio-security measure, feeding layer (L3 ration), increasing artificial light, culling and selection of layer and non- layer, vaccination, vitamin and antibiotics supplement, record keeping(daily feed consumption, egg production, medicine and vaccination, mortality, culling, sales record), comparison with performance record provided by the hatchery Feed and care broiler as layer
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.

Unit: 7 Vaccination, debeaking and deworming	**Hrs theory : 6**
Objectives	Contents
• Vaccinate poultry birds • Perform debeking • Deworm chicken	Vaccine and vaccination in poultry, Vaccination schedule for layer chicken, Vaccination method, Precaution to be taken Purpose of debeaking, age and method of debeaking, Precaution to be taken Anthelmintics used in poultry, dose of anthelmintics, method of deworming(with feed/ water)
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 8 Stress management inpoultry	**Hrs theory : 4**
Objectives	Contents
Protect bird from hot/ chilled weather	Summer management and winter management of poultry bird
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit: 9 Daily poultry farm opration and record keeping	**Hrs Theory : 6**
Objectives	Contents
Perform daily farm operation in poultry farm	Differentiate layer and non layer Perform culling Calculate feed and water intake and record Record medication and weekly/ daily weight gain Collect eggs of layer Record egg production for layer and sale of live birds for broiler

	Inspect activities of chicken
Evaluation Methods: Oral and written tests, assignments	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit :10 Prevent common diseases and parasites of poultry	Common diseases and parasites of poultry (study detail in animal health II)

Poultry Entrepreneurship Practical (64 hrs)

Poultry Entrepreneurship	**Hrs Practical :**
Practical 1: Identification of common poultry breeds of chicken	**Hrs :6**
Practical 2: Selection and culling of chicken	**Hrs :4**
Practical 3: Identification of common poultry tools and eqipments	Hrs :4
Practical 4: Disinfection of poultry farms before and after arrival of chicken	Hrs :4
Practical 5: Debeking, deworming and vaccination in poultry	**Hrs : 6**
Practical 6: Post mortem examination of poultry for disease diagnosis	**Hrs : 4**
Practical 7 : Site selection and lay out of poultry farm for different types of poultry	**Hrs : 8**
Practical 8: Local poultry farm visits	**Hrs : 4**
Practical 9: Biosecurity and **d**isinfection in poultry farms	**Hrs : 4**
Practical 10: Study of **e**xternal body parts of chicken	**Hrs :2**
Practical 11: Study of digestive organs of poultry	**Hrs : 2**
Practical 12: Study of reproductive organs of poultry	**Hrs : 2**

Veterinary Laboratory Techniques

Credit hours: 2+1/week **Full Marks: 100**

Total hours: 128 hours

Theory: 64 hours

Practical: 64 hours

Course Description

This course provides basic knowledge in laboratory disease diagnosis techniques including the common terms in laboratory techniques, animal handling and disease diagnosis. Basically this course is based on practical work of the students which is useful in their daily laboratory work or in disease diagnosis in the hospital or even field. Fecal, urine examination is the very basic for the livestock health management and other microbiological work which helps proper diagnosis as well as proper treatment of animal diseases.

Course Objectives

This Course has the following Objectives:

- explain the importance of lab techniques
- work in the national and private veterinary hospital/lab sector
- describe basic laboratory techniques of some important in disease diagnosis.
- demonstrate general knowledge in laboratory and disease diagnosis in animal.
- apply technical skills in disease diagnosis and disease investigation techniques.

Minimum Standards

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

Text and Reference books

Reference:

1. Dhakal, I.P. Laboratory Manual on Veterinary Microbiology and Parasitology. IAAS, Rampur.
2. Dhakal, I.P. Laboratory Manual on Disease of Farm Animals, IAAS, Rampur
3. Sah, N. and P. Jalen. Laboratory Manual of dairy Science
4. Sastry, G. Veterinary Clinical Pathology
5. Soulsby, E.J.L. Helminths, Anthropods and Protozoa of Domestic animals. ELBS Publication
6. Cruickshank. Medical Microbiology

Course:	**Hrs. Theory :** **Hrs. Practical :**
Unit- 1 Common laboratory equipment and their functions	**Hrs theory :** 12
Objectives	Contents
By the end of lecture students will be • Able to define lab and lab equipments • Able to understand function and use of lab equipments • Able to identify and use lab equipments • Able to understand the working principle of equipments • Able to explain and use the terms related to lab equipments,	Definition and objectives of use of lab equipments Common terms related to lab equipments: e.g. Sterilization, autoclaving, moist heat, dry heat, refrigeration, deep freezing, distillation etc. Principle behind the equipments Functions of lab equipments Identification and differention of instruments, e.g. Microscope: (simple, compound and binocular), Autoclave, Incubator, Hot air oven, Refrigerator, Centrifuge, Distillation set, Water bath, pH Meter, Colorimeter and Weighing balances
Evaluation Methods: Oral and written tests, assignment, real equipments identification and identification in poster, figure etc.	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, real equipments and reference books.
Unit-2 General laboratory procedures	**Hrs theory :** 7
Objectives	Contents
By the end of lecture students will be • Able to define and understand laboratory procedure. • Able to understand importance of lab and its procedure. • Able to understand the meaning of sterilization and materials used in sterilization. • Able to explain the terminologies used in lab procedure. • Able to do safety measure and storage of chemical, reagents and biological	Definition, importance and use of lab procedure Safety measure of lab procedure Sterilization, disinfectant and antiseptics Storage of chemicals, reagents and vaccines Cold chain maintenance, Collection, dispatch and receiving of samples Factors affecting lab procedures

preparations. • Able to do collection, dispatch and receiving of samples.	
Evaluation Methods: Oral and written test, assignment, Observation of skill performance	**Teaching /Learning activities and resources:** Class room instruction, Observation and demonstration, illustration, diagrams, visuals, textbooks, and reference books.
Unit 3. Parasitology	**Hrs Theory** 10
Objectives	Contents
By the end of lecture students will be • Able to Define parasites and Parasitology • Able to Explain and understand different terms used in Parasitology • Able to list different types of parasites • Able to understand different types of fecal examination and able to differentiate between them • Able to differentiate internal and external parasites of livestock and poultry • Able to perform fiscal examination • Able to do skin scraping	Definition of parasites and Parasitology Common internal parasites of livestock and poultry Terminology used in parasitology Faecal sample collection Faecal examination methods Common external parasites of livestock and poultry Skin scrapping test
Evaluation Methods: Oral and written test, assignment, performance observation	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books, real materials (external and internal) parasites, educational tour
Unit 4. Hematology	**Hrs Theory** 12
Objectives	Contents
By the end of lecture students will be • Able to understand blood and its composition. • Able to understand importance of blood	Introduction of Blood, its constituents Importance and function of blood Precautions while taking and handling of blood

and functions of blood. • Able to differentiate different types of blood cells and its functions. • Able to know different sites to withdraw blood from different species of animals. • Able to understand different methods of blood analysis as well as know the blood parameters of different animals.	samples Types of blood cells Blood sample collection methods Total count of RBC Total count of WBC Differential count of WBC Collection of blood serum Hemoglobin estimation Basic interpretation of data of blood test/analysis
Evaluation Methods: Oral and written test, assignment, Presentation, conduct demonstration	**Teaching /Learning activities and resources:** Classroom instruction, Observation, Practical classes, illustration, diagrams, visuals, textbooks, and reference books.
Unit 5 Urology	**Hrs Theory** 3
Objectives	Contents
By the end of lecture students will be • Able to define urine and urology • Able to know constituents of urine • Able to collect dispatch and handle urine • Able to do routine analysis of urine and interpretation of result.	Urinary system Terminologies used in urology. Urine and its constituents Urine sample collection, handling and dispatch Routine examination urine and result interpretation
Evaluation Methods: Oral and written test, assignment, presentation, model preparation	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, demonstration and reference books.
Unit 6 Microbiology	**Hrs Theory** 12
Objectives	Contents

By the end of lecture students will be • Able to define microbiology. • Able to understand merits and demerits of microbes and microbiology. • Able to prepare, store and inoculate bacterial media. • Able to examine culture and differentiate types of basal media and culture on that media. • Able to do Gram's staining, antibiotic sensitivity test. • Able to collect, handle and dispatch samples for Microbiology. • Able to do milk CMT and culture.	Definition of microbes and microbiology. Merits and demerits of microbes and microbiology. Preparation and storage of media Sample collection, handling and dispatch for bacteriology Inoculation of media from various types of specimen Examination of culture Bacterial colony morphology and bacterial morphology Gram's staining methods Antibiotic sensitivity test and its interpretation Examination of milk CMT and result interpretation. Milk culture for bacteria
Evaluation Methods: Oral and written test, assignment, Presentation and model preparation	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, demonstration and reference books.
Unit 7 Post-mortem examination of livestock and poultry	**Hrs theory** 4
Objectives	Contents
By the end of lecture students will be • Able to define and do post-mortem of livestock and poultry. • Able to identify organs of livestock and poultry. • Able to differentiate major abnormality of organs	Definition of post-mortem, time period of post-mortem, Anatomy and organs of livestock and poultry Terminologies used in post-mortem Procedure of post-mortem Importance of post-mortem, Interpretation of post-mortem

Evaluation Methods: Oral and written test, assignment, presentation and model preparation	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, demonstration and reference books.

Practicals

Veterinary Laboratory Techniques Practical	**Hrs Practical : 60**
Practical 1: Identification of common veterinary laboratory equipment	**Hrs :** 2
Objectives: By the end of Practical; students will be able to	Contents
* Identify and use lab equipments * Understand the importance of lab equipments	Visit to lab and hospital having lab equipments: e.g. Microscope: (simple, compound and binocular), Autoclave, Incubator, Hot air oven, Refrigerator, Centrifuge, Distillation set, Water bath, pH Meter, Colorimeter and Weighing balances
Practical 2: Handling and use of microscope	**Hrs 1**
Objectives: By the end of Practical; students will be able to	Contents
* Handle and use of microscope	Visit to a lab and practice with microscope
Practical 3: Preparation and cleaning of glassware	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Prepare glassware for cleaning * Clean glass ware	Glass wares Cleaning material Visit to lab
Practical 4: Method of sterilization	**Hrs 3**

Objectives: By the end of Practical; students will be able to	Contents
* Do moist heat sterilization e.g. autoclaving and boiling. * Do dry heat sterilization e.g. Use of hot air oven and flame.	Autoclave, electricity, hot air oven, burner, gas supply, glass wear, medias, water
Practical 5: Use of antiseptics	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Understand meaning of antiseptic and able to use in right place.	Lab with antiseptics e.g. savlone, lugols iodine, ethanol etc.
Practical 6: Use of disinfectants	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Understand meaning of disinfectant and use in right place.	Hospital or clinics with disinfectants e.g. detergent, virkon-s etc.
Practical 7 Morphological identification of trematodes	**Hrs 1**
Objectives: By the end of Practical; students will be able to	Contents
* Identify/recognize trematodes and its ova.	Figure of trematode and its ova, microscopic slide of trematode.
Practical 8: Morphological identification of nematodes	**Hrs 1**
Objectives: By the end of Practical; students will be able to	Contents
Able to identify/recognize nematodes and its ova.	Figure and slides of nematodes, real sample of nematodes
Practical 9: Morphological identification of cestodes	**Hrs 1**

Objectives: By the end of Practical; students will be able to	Contents
* Identify/recognize various cestodes and its segments or proglotids.	Figure and slides of different cestodes and its ova.
Practical 10: Identification of parasite eggs by faecal examination	**Hrs 4**
Objectives: By the end of Practical; students will be able to	Contents
* Prepare direct smear and observe for parasitic eggs. * Conduct faecal examination by sedimentation and flotation method. * Identify ova of trematodes, nematodes, cestodes.	Figure/charts of ova of trematode, nematodes and cestodes, Microscope, slides, cover slips, sieve, glasses , electricity supply etc.
Practical 11: Identification of external parasites	**Hrs 3**
Objectives: By the end of Practical; students will be able to	Contents
* Identify lice, flea, bug, leech, etc. * Identify eggs of lice.	Figure and posters of lice, flea, bugs and leech. Microscopic slides of external parasites. Real material demosntration
Practical 12: Identification of mange mites by skin scrapping test	**Hrs 3**
Objectives: By the end of Practical; students will be able to	Contents
* Take skin scrapings. * Prepare slides of skin scraping. * Identify mites.	Blades for scraping, diseased animal, slides, cover slips, KOH solution, microscope.
Practical 13: Collection of blood	**Hrs 1**
Objectives: By the end of Practical; students will be able to	Contents

* Collect blood from animal * Handle blood sample	Animal, syringe and needle, antiseptics and cotton, trevis
Practical 14: Preparation of blood smear	**Hrs 1**
Objectives: By the end of Practical; students will be able to	Contents
* Collect blood and prepare smear.	Blood with anticoagulant, slides
Practical 15: Total count of RBC	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Perform procedure to count RBC and able to count RBC	RBC diluting fluid, Counting chamber (Hemocytomoter), Cover slips, Microscope.
Practical 16: Total count of WBC	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Dilute and load to counting chamber * Count WBC and able to differentiate different WBC.	Blood, Counting Chamber, cover slip, Microscope, WBC diluting fluid.
Practical 17: Differential count of WBC	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Differentiate Different WBC * Count different WBC	Livestock and poultry, syringe, cotton swab, antiseptics (Blood), Counting Chamber, cover slip, Microscope, WBC diluting fluid.
Practical 18: Hemoglobin estimation	**Hrs 1**
Objectives: By the end of Practical; students will be able to	Contents
* Estimate Haemoglobin	Livestock and poultry, syringe, cotton swab, antiseptics (Blood), Haemoglobinometer,

	Pipette,
Practical 19: Preparation of blood serum	**Hrs 1**
Objectives: By the end of Practical; students will be able to	Contents
* Collect blood from livestock and poultry. * Prepare blood serum	Livestock and poultry, syringes, serum vials, antiseptics, cotton.
Practical 20: Identification of blood protozoa	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Identify blood protozoa	Blood positive blood protozoa, microscope, slides, cover slips
Practical 21: Routine examination of urine	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Examine colour, pH, odor, turbidity * Examine haematuria, haemoglobunuria * Examine urine for sugar protain, bile etc.	Test tubes, pH paper, urine, gloves, sulphur, microscope, slides, cover slips
Practical 22: Preparation of bacteriological media	**Hrs 3**
Objectives: By the end of Practical; students will be able to	Contents
* Measure exact amount of dehydrated media * Mix well media and distill water by heating and shaking * Do autoclaving * Pour media on sterilized petri-plates	Dehydrated media, conical flask, DW, sterilized petri-plates, burner, autoclave, insulating glove, balance, paper for media to measure.

* Prepare bacteriological media	
Practical 23: Inoculation of bacterial samples	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Sterilize the surface of organs with red hot spatula * Take inoculation sample through sterilized surface of organs by piercing inoculation loop/cotton bud * Inoculate the sample on media plate.	Culture media plates, burner, metal spatula, inoculation loop, cotton bud, bacterial infection suspected sample/organ
Practical 24: Pure culture preparation	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Understand the meaning of pure culture. * Differentiate between mix and pure culture. * Prepare pure culture.	Mixed culture plate, media plates with media, burner, inoculation loop, incubator
Practical 25: Stocking of bacteria	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Prepare broth culture of bacteria * Prepare 40% of glycerin * Stock bacteria	Broth culture of bacteria, stock vials, 40% glycerin, pipette, refrigerator/deep fridge
Practical 26: Gram's staining method for identification of bacteria	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Prepare bacterial smear, * Do Gram's staining	Glass slides, bacteria culture/colony, inoculation loop, distill water, burner, Gram's staining set, wash bottle, microscope, sedar

* Identify Gram positive and negative bacteria.	wood oil
Practical 27: Antibiotic sensitivity test (AST)	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Make broth culture * Spread culture broth on media plate * Put antibiotic disc on broth spread media plates, * Do AST * Interpret reading of AST	AST media plates, antibiotic discs, disc dispenser/forceps, scale, spreader, broth culture, pipette, burner
Practical 28: Examination of milk by California Mastitis Test (CMT)	**Hrs 2**
Objectives: By the end of Practical; students will be able to	Contents
* Collect sample in proper way. * Do CMT	CMT plate, CMT reagents, mastitis milk
Practical 29: Post-mortem (PM) examination of livestock	**Hrs 4**
Objectives: By the end of Practical; students will be able to	Contents
* Understand purpose of PM * Locate site for PM * Use right instrument * Locate organs and identify abnormality * Do PM of livestock * Dispose carcass in right place	PM set, livestock (dead body/killed), PM table/floor, Antiseptic solutions, soap, enough water, PM gloves, place for carcass disposal.
Practical 30: Post-mortem examination of	**Hrs** 2

poultry	
Objectives: By the end of Practical; students will be able to	Contents
* Understand purpose of PM * locate site for PM * Use right instrument * Locate organs and identify abnormality * Do PM of livestock * Dispose carcass in right place	PM set, poultry (dead body/killed), PM table, Antiseptic solutions, soap, enough water, PM gloves, place for carcass dispose

Animal Breeding and Artificial Insemination

Credit hours: 2+1/week **Full Marks: 100**

Total hours: 128 hours

Theory: 64 hours

Practical: 64 hours

Course Description of Theory

Animal breeding, important and its scope in livestock improvement. Animal genetic resources and sustainable development of indigenous breeds. Rare breeds of different species of animals and their characteristics and economic values, reason for being endangered, strategies and methods for conservation of AnGR, Variation and causes of variation, importance of heredity and environment. Gene action (additive and non additive). Selection, selection response, selection limit, selection differential, methods and basis of selection, mating system, inbreeding and out breeding. Hormonal mechanism in reproduction, male and female reproductive system, estrus detection, estrus cycle and estrus induction, estrus synchronization, ovulation. A.I. introduction, advantage and limitation of A.I., technique of A.I,. Method of semen collection, dilution, preservation, thawing, transportation. Embryo transfer, importance, techniques, super ovulation, collection, synchronization and transfer of embryo. Animal biotechnology and recent advances in animal biotechnology.

Course Description of Practical

Variation and causes of variation, selection response, selection limit, selection differential, genetic gain, estrus detection, palpation, preparation AV, Method of semen collection, dilution, preservation, thawing, transportation. A.I. and different techniques of A.I,.

Course Objectives

This Course has the following Objectives:

- Understand basic principles of animal breeding
- Know the fundamentals of animal reproduction
- Apply the application of reproductive techniques for genetic improvements of livestock

Minimum Standards

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

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Text and Reference books

Rendel I. J. Genetics and Animal Breeding. W.H. Freeman and Company.USA

Lasley, J.F., 1963. Genetics of Livestock Improvement 3rd edition. Prentice-Hall. Inc., Englewood Cliffs, New Jersey.

Luish J.L.1960.Animal Breeding Plans.Iowa State University Press,Ames, Iowa.

Nicholl, D.S.T. 1994. An introduction to genetic engineering. Cambridge University Press.

Stufflebeam C.E. 1989.Genetices of Domestic Animals. Prentice Hall, Englewood Cliffs, New Jersay

Warick and Legates, 1979. Breeding and Improvement of Farm Animals.

Hafez, E.S.E. (1993). Reproduction in Farm Animals (6^{th} edt.). Lea and Febiger, Philadelphia,

Hafez, E.S.E. and Hafez, B. (2000). Reproduction in Farm Animals (7th edition). Lea and Febiger, Philadelphia, USA.

Eckert and Randall, 1983. Animal Physiology

Pearese, 1989. Animal ecology

McDonald, 1989. Veterinary Endocrinology

Course: Animal Breeding and AI : Theory			
Unit	Objectives	Contents	Contact hrs.
1	Upon completion of this contents students understands about animal breeding, importance and scope	Animal breeding, importance and its scope in livestock improvement.	2
	Evaluation Methods: Oral and written test	**Teaching/Learning activities and resources:** Classroom instruction through power point with providing handout, illustration, diagrams, articles and books	
2	Upon completion of this contents students understands about animal genetic resources, rare breeds their characteristics and economic values and their conservation.	1. Animal genetic resources and sustainable development of indigenous breeds. 2. Rare breeds of different species of animals and their characteristics and economic values. 3. Reason for being endangered, strategies and methods for conservation of AnGR.	7

	Evaluation Methods: Oral and written test	**Teaching/Learning activities and resources:** Classroom instruction through power point with providing handout, illustration, diagrams, articles and books	
3	Students understands about heridity and environment	Variation and causes of variation, important of heredity and environment	3
	Evaluation Methods: Oral and written test	**Teaching/Learning activities and resources:** Classroom instruction through power point with providing handout, illustration, diagrams, articles and books	
4	Students understands about gene action in livestock	Gene action (additive and non additive).	2
	Evaluation Methods: Oral and written test	**Teaching/Learning activities and resources:** Classroom instruction through power point with providing handout, illustration, diagrams, articles and books	
5	Students understands about selection and mating system in animal breeding	Selection, selection response, selection limit, selection differential, methods and basis of selection, mating system (inbreeding and out breeding).	7
	Evaluation Methods: Oral and written test	**Teaching/Learning activities and resources:** Classroom instruction through power point with providing handout, illustration, diagrams, articles and books	
6	Students understands about role of hormones in reproduction	Hormonal mechanism in reproduction (Hormones involved in reproduction estrogen, progesterone, testestoren FSH, LH, PGf2α……)	6
	Evaluation Methods: Oral and written test	**Teaching/Learning activities and resources:** Classroom instruction through power point with providing handout, illustration, diagrams, articles and books	
7	Students understands about reproductive system of different farm animals	Male and female reproductive organs (cattle, buffalo, sheep, goat, pig)	5
	Evaluation Methods: Oral and written test	**Teaching/Learning activities and resources:** Classroom instruction through	

		power point with providing handout, illustration, diagrams, articles and books	
8	Students understands about estrus and ovalation	Estrus; heat detection in cattle, buffalo, sheep, goat and pig; estrus cycle and estrus induction, estrus synchronization, ovulation.	6
	Evaluation Methods: Oral and written test	**Teaching/Learning activities and resources:** Classroom instruction through power point with providing handout, illustration, diagrams, articles and books	
9	Students understands about AI	A.I. introduction, advantage and limitation of A.I., technique of A.I,.	6
	Evaluation Methods: Oral and written test	**Teaching/Learning activities and resources:** Classroom instruction through power point with providing handout, illustration, diagrams, articles and books	
10	Students understand about semen collection, dilution, preservation, thawing, transportation.	Method of semen collection, dilution, preservation, thawing, transportation.	6
	Evaluation Methods: Oral and written test	**Teaching/Learning activities and resources:** Classroom instruction through power point with providing handout, illustration, diagrams, articles and books	
11	students understand about embro transfer technology	Embryo transfer, importance, techniques, super ovulation, collection, synchronization and transfer of embryo.	5
	Evaluation Methods: Oral and written test	**Teaching/Learning activities and resources:** Classroom instruction through power point with providing handout, illustration, diagrams, articles and books	
12	Students understands about embro transfer technology	Animal biotechnology and recent advances in animal biotechnology.	5
	Evaluation Methods: Oral and written test	**Teaching/Learning activities and resources:** Classroom instruction through power point with providing handout, illustration, diagrams, articles and books	

Course Title: Animal Breeding and Artificial Insemination (2+1): Practical			
Unit	Objectives	Contents	Contact hrs.
1	Students understands about variation and causes of variations in farm animals	Variation and causes of variation	2
	Evaluation Methods: Oral and written test with practical work	**Teaching/Learning activities and resources:** Classroom instruction through power point with illustration, diagrams, observation taking measurements in different farm animals of different characters and their calculation.	
2	Students understands about selection response, selection limit, selection differential, genetic gain	selection response, selection limit, selection differential, genetic gain,	3
	Evaluation Methods: Oral and written test with practical work	**Teaching/Learning activities and resources:** Classroom instruction through power point with illustration, diagrams, observation taking measurements in different farm animals of different characters and their calculation.	
3	Students understands about Estrus detection in cattle, buffalo, sheep, goat and pig	Estrus detection (Heat detection in different farm animals: cattle, buffaloes, sheep, goat and pig.)	3
	Evaluation Methods: Oral and written test with practical work	**Teaching/Learning activities and resources:** Classroom instruction through power point with illustration, diagrams, observation taking in cattle, buffaloes, sheep, goat and pig.	
4	Students understands about internal parts of organ (ovary, uterus and pregnancy diagnosis in large animals)	Palpation in different farm animals (cattle, buffaloes)	4
	Evaluation Methods: Oral	**Teaching/Learning activities and**	

	and written test with practical work	**resources:** Classroom instruction through power point with illustration, diagrams, observation taking in cattle, and buffaloes.	
5	Students understands about AV	Artificial vagina (AV) for large animal and small animal and its preparation	4
	Evaluation Methods: Oral and written test with practical work	**Teaching/Learning activities and resources:** Classroom instruction through power point with illustration, diagrams, and construction AV assembling all parts.	
6	Students understands about semen collection from bull, ram, buck and boar	Method of semen collection in bull, ram, buck and boar	4
	Evaluation Methods: Oral and written test with practical work	**Teaching/Learning activities and resources:** Classroom instruction through power point with illustration, diagrams, and directly collection from bull, ram, buck and boar	
7	Students understands about Semen dilution, preservation, thawing, transportation	Semen dilution, preservation, thawing, transportation	4
	Evaluation Methods: Oral and written test with practical work in lab	**Teaching/Learning activities and resources:** Classroom instruction through power point with illustration, diagrams, and lab work	
8	Students understands about Artificial Insemination in cattle, buffalo, sheep, goat and pig	A.I. and AI in different farm animals (cattle, buffalo, sheep, goat and pig) techniques of A.I,.	6
	Evaluation Methods: Oral and written test with practical work	**Teaching/Learning activities and resources:** Classroom instruction through power point with illustration, diagrams, and practically work in cattle, buffalo, sheep, goat and pig	

Equine, Rabbit and Pet Animals

Credit hours: 2+1/week **Full Marks: 100**

Total hours: 128 hours

Theory: 64 hours

Practical: 64 hours

Course Description

This course provides basic knowledge in equine, rabbit and pet animals including the common terminologies, their management, breeding and prevention and treatment for major disease problems.

Course Objectives

This Course has the following Objectives:

- Understand equine breeds, their management, breeding, lameness problems, shoeing techniques, and know the major health problems.
- Understand the techniques of rabbit keeping, rabbit breeds, their uses and marketing.
- Understand the importance of of pet animals, dogs as pet animals, and dog breeds, management, breeding and their major health issues.

Minimum Standards

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

Books and references:

1. Elisabeth Downing. Keeping Rabbits. Garden farming series, Pelham Books.
2. Malanie Bailey. Equine Stud Management. J. A. Allen and Co Ltd.
3. Chakrabarti Amalandu, Dog Care and Management.
4. Angela Sayer and Howard Loxton- Encyclopedia of Cat.
5. Prof, Dr. K.D.Budras, Dr, P.H. Mc. Carthy, Anatomy of dog- an illustrated text.

Course:	
Unit- 1 Introduction to equines	**Hrs theory : 2**
Objectives	Contents
• Introduction about equines	Introduction of equine species and their

	distribution Anatomical features of equine
Evaluation Methods: Oral and written tests, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit-2 Equines breeds	**Hrs theory : 2**
Objectives	Contents
Know equine breeds with their importance	Major breeds of equine worldwide Major equine breeds in Nepal Importance of horses
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. Equine management	**Hrs Theory 4**
Objectives	Contents
Understand equine management and breeding practices	Housing for horses Feeding horses (draft horses and race horses) Parasitic control (external and internal) in horses Breeding season of horses, estrus cycle in mares and breeding time Management of pregnant mares and foals
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. Equine lameness	**Hrs Theory 4**
Objectives	Contents

• Understand equine lameness and its management	Lameness in equine and its types Lameness management Shoeing types and techniques
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 5 Equine health	**Hrs Theory 8**
Objectives	Contents
• Understand major equine health problems with their prevention and treatment knowledge	Major bacterial diseases of equines with their treatment principles Major viral diseases of equines with their prevention and vaccination Major fungal diseases of equines with their treatment principles Major metabolic diseases of equines with their treatment principles
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 6 Introduction to rabbit keeping	**Hrs Theory 2**
Objectives	Contents
• Introduction about rabbits	Introduction and classification of rabbit Scope of rabbit production Economic importance of rabbit
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Classroom instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.

Unit 7 Breeds, management and breeding of rabbit	**Hrs 6**
Objectives	Contents
• Understand rabbit management and breeding of different types of rabbit breeds	Major breeds of rabbit Housing and feeding practices for rabbits Estrus cycle and breeding time
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 Rabbit health	**Hrs Theory 8**
Objectives	Contents
• Understand rabbit health, prevention and treatment of major disease problems	Major diseases of rabbits with their prevention and treatment
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 Skinning of rabbits	**Hrs Theory 4**
Objectives	Contents
• Know the technique of skinning of rabbits for commercial purpose	Slaughtering and skinning techniques of rabbits
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 Introduction to pet animals	**Hrs theory 2**
Objectives	Contents
• Understand about pet animals	Definition of pet animals Major pet animals in Nepal

	Dog and cat as pet animals
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 Breeds of dogs and cats	**Hrs theory 4**
Objectives	Contents
• Understand about dog and cat breeds	Major dog breeds and their characteristics Major cat breeds and their characteristics
Evaluation Methods: Oral and written test, assignment	**Teaching /Learning activities and resources:** Class room instruction, Observation, illustration, diagrams, visuals, textbooks, and reference books.
Unit 12 Breeding of dogs and cats	**Hrs theory 4**
Objectives	Contents
• Understand about dog and cat breeding	Estrus cycle and mating in dogs Estrus cycle and mating in cats Care of pregnant bitches and queens Care of puppies and kittens
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 Prevention and treatment of major diseases of dogs and cats	**Hrs theory 10**
Objectives	Contents
• Understand and manage the major health problems of dogs and cats	Major diseases of dogs, vaccination in dogs and treatment of diseases Major diseases of dogs, vaccination in dogs and

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

Practicals

Equine, Rabbit and Pet Animals Practicals	**Hrs Practical : 30 hrs**
Practical 1: Visiting stud farms and other horse stables	**Hrs : 10**
Objectives	Contents
• Understand equine management, feeding, breeding and lameness management	Observation of equine housing, feed types and feeding practices Breeding methods of horses Types of equine shoes and shoeing methods Shoeing types for different lameness management
Practical 2: Practical knowledge on rabbit keeping	**Hrs 10**
Objectives	Contents
• Acquire the practical knowledge of identifying rabbit breeds, their management and skinning techniques	Identification of rabbit breeds by observing the live rabbits and photographs Techniques of preparing rabbit houses Techniques of preparing rabbit feed Techniques of rabbit breeding Techniques of rabbit deskinning
Practical 3: Dog and cat management	**Hrs 10**
Objectives	Contents

• Acquire the practical knowledge on dog and cat management	Identification of dog and cat breeds by observing the live animals and photographs Feeding knowledge of dogs and cats Techniques of dogs and cat breeding Vaccination and its techniques in dogs and cats Spaying techniques of male and female dogs

Veterinary Clinical Practices

Credit hours: 0+1**/week** **Full Marks:** 50

Total hours: 128 hours

Theory: hours

Practical: 64 hours

General objective:

The objective of this Veterinary Clinical Practices cum Project work is to develop confidence among the students in their skill and knowledge and make them able to apply the acquired skill and knowledge in enterprises (Animal health, animal production and agro-vet services, etc.) In case of Veterinary Clinic Practices they must do practices in veterinary lab and for project work they can be selected by themselves with the aid of an assigned supervisor.

SN	Clinical Activities	Total 64 Hours
1	Orientation to veterinary clinics	**2 hrs**
2	Filling of registration cards and history taking.	**2 hrs**
3	Practice of first aid procedures and emergency medicine.	**2 hrs**
4	Clinical examination of the patient with emphasis on history taking, examination techniques i.e. palpation, percussions and auscultation.	**2 hrs**
5	Physical examination of animals i.e. temperature, respiration, pulse rate and ruminal movements.	**2 hrs**
6	Routes of administration of drugs and vaccines.	**2 hrs**
7	Practice of I/M,S/C,I/V, I/p, I/occular and I/mammary infusion.	**2 hrs**
8	Handling, examination, diagnosis and treatment of sick animals under field conditions.	**2 hrs**
9	Pregnancy diagnosis techniques by rectal palpation.	**4 hrs**
10	Faecal examination techniques i.e. Direct smear methods, floatation techniques and sedimentation techniques.	**4 hrs**
11	Techniques of skin scraping methods.	**2 hrs**
12	Examination of cases of anoestrus.	**2 hrs**
13	Postmortem techniques in poultry	**2 hrs**

Project Activities: Students are required to undertake one of the following activities in the third year of the program and submit the written report and presentation in the class.

1. Poultry (broiler) production
2. Goat, sheep or rabbit raising
3. Dairy processing (preparation of milk products)
4. Market survey of animal and animal products
5. Other activity or case study identified by the training institute

Evaluation

Evaluation and mark distribution is as follows:

S.N	Who does evaluate?	Marks
1	Supervisor of Training Institute (internal)	80
2	CTEVT or its nominee (external)*	20
	Total	100

Written report: 50%

Presentation skill: 25%

Oral or Viva : 25%

Total 100%

* Students are required to secure 40 percent marks in the external examination conducted by CTEVT to pass the course.

Work Experience Program (WEP)

Credit Hours: 0+12

Full Marks: Practical 300

General objectives:

The objective of the WEP is to make students familiar with/ gain firsthand experience of the world of work as well as to provide them an opportunity to gain skills that are new or not covered in the institute.

Activity:

In this program the students will be placed in the job market under the supervision of supervisors in the organizations such poultry farm, hatchery, animal feed industries, dairy plant, veterinary hospital, veterinary clinics, avian lab, central vet lab, district livestock service office, vets service center, vet quarantine office, vet drug shop, livestock farm, piggery, NGOs/INGOs working in livestock and veterinary fields etc.). The nature of the training is practical works and the duration will be of three (3) months (480 hours). The student will be eligible for WEP only after the completion of all classes of the subjects included in the curriculum. WEP should be completed at least 2 weeks before the start of 3rd year final examination of CTEVT. The training institute will make arrangement for WEP. The institute will inform the CTEVT at least one month prior to the WEP placement date along with plan, schedule, the name of the students and their corresponding WEP site.

A) Complete WEP Plan

SN	Activities	Duration	Remarks
1	Orientation	2 days	Before WEP placement
2	Report to the site	1 days	Before WEP placement
3	Actual work at the WEP site	90 days/480 hours	During WEP period
4	Mid-term evaluation	one week	After 6 to 7 week of WEP start date
5	Report to the parental organization	1 days	After WEP placement
6	Final report preparation	5 days	After WEP placement
7	Seminar/ evaluation from CTEVT or its nominee(external)	3 days	After 10 days of completion of WEP

- After 6 weeks of WEP placement mid-term evaluation should be made by the institute or jointly with CTEVT.
- After completion of 3 months WEP period, students will be provided with one week period to review all the works and prepare a comprehensive final report.
- WEP seminar date and time will be fixed by the institute after one week of the completion of WEP by making consent with the CTEVT.
- Final evaluation will be made according to the marks at the following evaluation scheme but mid-term evaluation record will also be considered.

B) Detail plan of work of WEP during 3 months (90 days)/480 hours.

SN	Activities	Days	Remarks
1	Gain knowledge and experience about the daily official works and activities of the WEP site: Organizational structure; duty ,responsibility, facilities(salary, perk, benefits, leave system, PF, gratuity, pension etc) of the employee of WEP site organization;	5 days	

	Annual work plan, reporting system		
2	Clinical practice and lab work experience: Minimum 30 clinical case handling or observation rerecord should be maintained in case record form or in daily diary and 20 lab test record	60 days	
3	Gain experiences about livestock and poultry farm management and fodder cultivation practices: Should visit and prepare a report about at least one commercial poultry/ livestock farm or about 5 traditional animal farm house including feeding, housing, health services, fodder supply, forage cultivation practices, farm record keeping system etc.	15 days	
4	Community field work experiences: data collection about socioeconomics and cultural aspects and livestock farming system of the purposively selected ethnic community such as Darai community, Tharu community, Musahar, Chepang, Dalit, Brahman- Chetri, Gurung, Magar and other Mixed type of communities	10 days	
	Total	**90 days**	

C) Evaluation scheme:

Evaluation and mark distribution is as follows:

S.N	Who does evaluate?	Marks
1	Supervisor of the organization in which the student is placed for WEP	100
2	The Training Institute	100
3	CTEVT or its nominee (external)*	100
	Total	**300**

*** Students are required to secure 40 percent marks in the external examination conducted by CTEVT to pass the course.**

Revision of Diploma in Agriculture (I. Sc Ag Animal Science)

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