CURRICULUM

PCL / Diploma in Health Sciences
(First year)

(General Medicine, Medical Laboratory Technology, Diagnostic Radiography, Homeopathy, Ayurveda, Amchi Science, Dental Science, Ophthalmic Science, Pharmacy, Physiotherapy and Acupuncture, Acupressure & Moxibustion)

Council for Technical Education and Vocational Training

Curriculum Development Division

Sanothimi , Bhaktapur

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Second revision 2016

Second revision 2024

Contents

Introduction

This Curriculum is designed to serve as the cornerstone for more advanced studies and specialized fields within health science. A strong foundation in general science prepares students for more specialized areas of study. It ensures that they have the necessary background to tackle advanced coursework and professional practice with confidence. This preparation is crucial for success in areas such as medical research, clinical practice, and health policy.

Teacher and Student Ratio

The ratio between teachers and students must be:

- Overall ratio of teacher and student must be 1:10 (at the institution level)
- 1:40 for theory and tutorial classes
- 1:10 for practical classes
- 75% of the teachers must be full-timers.

Qualification of Teachers and Instructors

- The program coordinator should have a master's degree in the related area or as per minimum requirements of CTEVT.
- The disciplinary subject related teacher should be a master's degree holder in the related area or as per minimum requirements of CTEVT.
- The demonstrators should have a bachelor's degree in the related area with two years' experience in training activities or as per minimum requirements of CTEVT.

Instructional Media and Materials

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

- ***Printed Media Materials*** **(**assignment sheets, handouts, information sheets, individual training packets, performance checklists, textbooks etc.).
- ***Non-projected Media Materials*** (display, models, flip chart, poster, writing board etc.).
- ***Projected Media Materials*** (opaque projections, multimedia projector, slides etc.).
- ***Audio-Visual Materials*** (audiotapes, slide-tape programs, videodiscs, videotapes etc.).
- ***Computer-Based Instructional Materials*** (computer-based training, interactive video etc.).

Teaching Learning Methodologies

The methods of teachings for this curricular program will be a combination of several approaches such as illustrated lecture, group discussion, demonstration, simulation, guided practice, fieldwork, block study, industrial practice, report writing, term paper presentation, experiment and other independent learning exercises.

- **Theory:** Lecture, discussion, interaction, illustrated talks, assignment, group discussion, demonstration, group work.
- **Practical:** Demonstration, observation, simulation, guided practice, self-practice, project work, field work, industrial practice, report writing, term paper presentation, experiment.

Mode of Instruction

There will be an inductive and deductive mode of education.

Evaluation Scheme

a. Internal assessment

- There will be written and practical exams for each subject both in theory and practical.
- Each subject will have 3 internal assessments each year at regular intervals and students must get feedback about it.
- The weightage of theory and practical marks are mentioned in course structure.
- Continuous assessment format will be developed and applied by the evaluators for evaluating student's performance in the subjects related to the practical experience.

b. Final examination

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

c. Requirement for final practical examination

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

d. Final practicum evaluation will be based on:

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

e. Pass marks:

- The students must secure a minimum of 40% marks in theory and 60% marks in practical. Moreover, the students must secure minimum pass marks in the internal assessment and in the semester final examination of each subject to pass the subject.

Provision of Back Paper

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

Disciplinary and Ethical Requirements

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

Grading System

The following grading system will be adopted:

- Distinction: 80% and above
- First division: 65% to below 80%
- Second division: 50 % to below 65%
- Pass division: Pass marks to Below 50%

Course Duration

The total duration of this curricular program is three academic years. The program is based on a yearly system. Moreover, one academic year consists of up to 35 weeks and one academic week consists of up to 40 hours excluding evaluation period.

Medium of Instruction

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

Pattern of Attendance

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

Question Patterns for Final Written Exam

The question patterns for the written exam are suggested as follows.

A. For subject with full marks 80

S.N.	Type of question	No of Question	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	2	10	20	60.min	1
2	Short	4	5	20	60. min	2
3	Very short	10	2	20	40. min	2
4	Multiple	20	1	20	20min	
	Total	36		80	180min	

B. For subject with full marks 40

	Type of question	No of Question	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	1	10	10	30 min	1
2	Short	2	5	10	30 min	1
3	Very short	5	2	10	20 min	1
	Multiple	10	1	10	10 min	
	Total	18		40	90 min	

Curriculum Structure

PCL/Diploma In Health Science First Year (All Program Except Nursing),

Year: I

S. N.	Code No.	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	Theory			Practical				
			L	T	P	L / C			Assmt. Marks	Final		Assm. Marks	Final			
										Marks	Time (Hrs.)		Marks	Time (Hrs.)		
1		Nepali	3				3	3	20	80	3	-	-		100	*continuous assessment
2		English	3				3	3	20	80	3	-	-		100	
3		Social Studies	2				2	2	10	40	1.5	-	-		50	
4		Anatomy and Physiology	4				4	4	20	80	3	-	-		100	
5		Physics	4			2	6	5	20	80	3	30	20	1.5	150	
6		Chemistry	4			2	6	5	20	80	3	30	20	1.5	150	
7		Zoology	3			2	5	4	20	80	3	30	20	1.5	150	
8		Botany	3			2	5	4	20	80	3	30	20	1.5	150	
9		Mathematics and Statistics	4	1		1	6	5	20	80	3	25	-	-	125	
		Total	**30**	**1**		**9**	**40**	**35**	**170**	**680**		**120**	80		**1075**	

नेपाली

जम्मा: ३घण्टा /हप्ता
लेक्चर: ३घण्टा /हप्ता
टुटोरियल: ०घण्टा /हप्ता
प्राक्टिकल: ०घण्टा /हप्ता
ल्याव: ०घण्टा /हप्ता

पाठ विवरण

यो पाठ्यांश प्रवीणता प्रमाणपत्र तहमा अध्ययन गर्ने विद्यार्थीहरुका लागि नेपाली भाषाको व्याकरणात्मक ज्ञान र सूझको विकासका साथै पठनबोध र अभिव्यक्ति क्षमताको विकास गर्ने दृष्टिले राखिएको हो । यसलाई मूख्यतः दूई खण्डमा बांडिएको छः व्याकरण खण्ड र बोध (अभिव्यक्ति) खण्ड । व्याकरण अन्तरगत वर्ण, वर्णविन्यास, शब्दवर्ग, रुपायन, शब्द निर्माण र वाक्यसम्बन्धी पाठ्यवस्तुहरु राखिएका छन् भने बोध (अभिव्यक्ति अन्तरगत सामान्यबोध र प्रयोजनपरक बोधका साथै अभिव्यक्ति रचनाका लागि अपेक्षित सीपहरु र समीक्षाका लागि साहित्यिक विधाका पाठहरु समाविष्ट छन् ।

पाठ्यांशको उद्देश्यः

यो पाठ्यांश पुरा गरेपछि विद्यार्थीहरु निम्नलिखित कूरामा सक्षम हूनेछन्:

- कथ्यभाषा र लेख्यभाषाका बीचको भिन्नता पहिल्याउन ।
- अभिव्यक्तिमा प्रयोग हुने शब्दहरूको उपयुक्त वर्णविन्यास लेख्न ।
- शब्दहरुको वर्ग-पहिचान गर्न, रुपायन गर्न र निर्माण गर्न ।
- वाक्यतत्व र वाक्यान्तरणका कडीहरु बुझेर आफ्ना अभिव्यक्तिमा तिनको उपयूक्त प्रयोग गर्न ।
- खास वाक्यतत्वसंग सम्बद्ध ढांचा र संदर्भका आधारमा अनुच्छेद रचना गर्न ।
- स्तर अनुरुप पाठ्यसामग्रीमा प्रयुक्त शब्दहरुका आधारमा शब्दभण्डारको विस्तार गर्न ।
- बोध र संक्षेपीकरणका पाठ्यसामग्रीमा प्रयुक्त शब्दहरुका आधारमा शब्दभण्डारको विस्तार गर्न ।
- ज्ञाँन-विज्ञाँनका विभिन्न शीर्षकहरुमा स्वतन्त्र रुपमा अनुच्छेद र निबन्ध रचना गर्न ।
- तोकिएका आधारमा साहित्यिक कृतिहरुको समीक्षा गर्न ।

एकाई १. वर्ण र वर्णविन्यास : १० घण्टा

(क) <u>उच्चार्य वर्णहरुको परिचय</u> :

स्वर र व्यञ्जन वर्णहरु
देवनागरी लिपि र उच्चार्य नेपाली वर्णहरू
नेपाली अक्षरहरुको संरचना

(ख) वर्ण विन्यास :

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, शिरविन्दु र चन्द्रविन्दु, हलन्त, पदयोग र पदवियोग तथा लेख्य चिन्ह सम्बन्धी अशुद्धि संशोधन अभ्यास

एकाई २. शब्दभण्डार : २० घण्टा

शब्दवर्ग, शब्दरुपायन र शब्द निर्माण

- स्रोतका आधारमा शब्दहरुको परिचय, पहिचान र प्रकार
- ब्यूत्पादनका आधारमा शब्दहरुको परिचय, पहिचान र प्रकार
- शब्दवर्ग-नाम, सर्वनाम विशेषण, क्रियापद, नामयोगी, क्रियायोगी, संयोजक, विस्मयादिवोधक र निपातहरुको पहिचान- अभ्यास
- शब्दरुपायन-नाम, सर्वनाम र विशेषणको लिé, वचन, आदर, कारकका आधारमा तथा क्रियापदको लिé, वचन, पुरुष, आदर, काल, पक्ष, भाव, वाच्य र अकरणका आधारमा शब्दरुपायनको अभ्यास।
- शब्द निर्माण अभ्यास
- निम्नलिखित उपसर्गहरुद्वारा शब्दनिर्माणको अभ्यास :
  प्र, अप, सम्, अनु वि, अधि, उत्, प्रति, परि, उप, सु, नि, निर, दुर्, अ, अन, कु ।
- निम्नलिखित कृत् प्रत्ययद्वारा शब्दनिर्माणको अभ्यास :
  आइ, ओट, ओ, आउ, आहा, अक्कड, उवा, इलो ।
  अक, अन ई इत, य, तव्य ।
- निम्नलिखित तद्धित प्रत्ययहरुद्वारा शब्दनिर्माणको अभ्यास :
  आइ, आली, इया, इलो, ई, ए, एली, ली, ले ।
  इक, ई, ईय, इत, ता, त्व, मान, वान, आलु ।
- समस्त शब्दहरुको पहिचान र तत्पुरुष, कर्मधारण, द्विगू, द्वन्द्व, अव्ययीभाव, र वहुब्रीहिको प्रक्रियाबाट समस्त शब्दहरुको निर्माण गर्ने अभ्यास

एकाई ३. बाक्यतत्व, वाक्यान्तरण २० घण्टा

(क) वाक्यत्तत्वः उद्देश्य र विधेयको पहिचान
- क्रिया र यसका प्रकार
- वाक्यका प्रकार : सरल र जटिल वाक्यको पहिचान
- वाक्य संश्लेषण र विश्लेषण
- लिé, वचन, पुरुष र आदरका आधारमा कर्ता र क्रियापदका बीचको séति सम्बन्धी अभ्यास
- विशेष्य-विशेषण र नाम-सर्वनामको बीचको séति सम्बन्धी अभ्यास
- विभक्ति-नियम तथा ले, लाई, देखि, बाट, द्वारा, को, का, की, रो, रा, री, नो, ना, नी, मा आदि विभक्ति प्रयोगको अभ्यास
- सरल र तिर्यक् विभक्तिनियमको अभ्यास

(ख) वाक्यान्तरण :
- विभिन्न काल, पक्ष, भाव, अकरण, वाच्य, प्रेरणार्थक आदिमा वाक्यान्तरण गर्ने अभ्यास

एकाई ४. बोध र शब्दभण्डार १० घण्टा
- चिकित्सा विज्ञानसम्बन्धी गद्यांशको बोध र शब्दभण्डारको अभ्यास
- चिकित्सा, शल्य चिकित्सा तथा स्वास्थ्य विज्ञान सम्बन्धी प्राविधिक शब्दहरुको ज्ञान अभ्यास (अर्थ लेख्ने र अर्थ खुल्ने गरी वाक्यमा प्रयोग गर्ने)

इन्द्रलुप्त, उत्क्लेस, ज्वर, पाण्डुरोग, प्रमेह, मधुमेह, पित्तदोस, प्रदर (१. रक्तपदर, २. स्वेतप्रदर) क्षयरोग, नशच्छेदन, रक्तचाप, उच्च रक्तचाप, न्युन रक्तचाप, गर्भपात÷पतन, हृदयरोग, पाचनक्रिया, पित्तविकार, रक्तविकार, चिकित्सा, निदान, परिचारिका, प्रसववेदना, प्रसुति, औषधालय, चिरफार, बहिरंग, हिक्का, हरिताल पार्नु, हरिनाश, हियो उठ्नु, वातज्वर, सिफर पल्टिनु, सिéारु, सेपाउनु, सप्को गर्नु, सन्निपात, सभिपात, शल्य चिकित्सा, शुल, शल्योपचार, मासु फरफराउनु, माथा विग्रनु, माटे, माई, भुंग्रेज्वरो, बेर्नु निस्कनु, बालतोड, बाथ, बान लाग्नु, बाउंडिनु, बहलाग्नु, बमन, विरेचन, फूस्रिनु, फूलो पर्नु, फाकफुक, पौंठा बस्नु, पेट बटारिनु, पेट काट्नु, पेट पोल्नु, पिनाश, पाछ्नु, निसलोठ, धम्की, दोख, दमै खटिरो, दम, डकार्नु, ठेउला, झूसिलो डकार आउनु, झिजो मान्नु, झाडा, जिरिé गर्नु, जल गडा, जनै खटिरा, जगाउनु, छोप्नु, छेर्नु, चिलचिलाउनु, चिप्रा बस्नु, चस्का पर्नु, घमौरा, गला लाग्नु, गलगण्ड, गलफुलो (हांडे), गोला चल्नु, गानो चल्नु, खरापानी लाग्नु, कण्डु, कुण्ठ, कोर, कोख, कैंठिनु, कुजो, कांसो लाग्नु, कास, काम्नु, कामज्वर, कांडो, कांध लाग्नु, काई लाग्नु, कब्जियत, औसनी लाग्नु, औडाहा चल्नु, ओछ्यान पर्नु, ओखत मूलो, ओइलाउनु, ऐंठन, उभर्को लाग्नु, उदररोग, उपर्तली, उकुच पल्टनु, अर्बुद, अजीर्ण, अपस्मार, आन्द्रा बटार्नु, आंत, आंठी गांठी, आंठे, आङ् चल्नु, आक्तो, आउं, अरुची, अम्मल, अमल पित्त, अमन हूनु, अग्नी जाग्नु, अतिसार, अंधो खटिरा, स्वेदन ।

एकाई ५. संक्षेपीकरण : **४ घण्टा**

- बुदा टिपोट गरी संक्षेपीकरण गर्ने अभ्यास
- अनुच्छेद, पत्र, निवेदन, विज्ञापन, तमसुक, बैठक निर्णय र प्रतिवेदन लेखन
- ज्ञान विज्ञान र प्रविधिसंग सम्बन्धित विभिन्न विषय शीर्षकमा अनुच्छेद लेख्ने अभ्यास
- प्रश्नावली तयार गर्ने
- टिप्पणी तथा प्रतिवेदन तयार गर्ने

एकाई ६.निबन्ध लेखन : **८ घण्टा**

- निवन्ध योजना र सोसंग सम्बन्धित बुदा अनूरुप अनूच्छेद गठनको अभ्यास
- वस्तुपरक र भावपरक निवन्ध लेखनको अभ्यास

एकाई ७ कृति समीक्षा : **३३ घण्टा**

- विषयवस्तु, कथानक, पात्र, परिवेश, सन्देश, शीर्षक र भाषा शैलीका आधारमा निम्नलिखित रचनाहरुको समीक्षात्मक अभ्यास

कथा :

गूरु प्रसाद मैनाली	छिमेकी
विश्वेश्वरप्रसाद कोइराला	सिपाही
इन्द्रबहादुर राई	रातभरि हुरी चल्यो
रमेश विकल	मधुमालतीको कथा

निबन्ध :

लक्ष्मीप्रसाद देवकोटा	पहाडी जीवन

सुधा त्रिपाठी	संस्कृतिको नयां यात्रा
भैरव अर्याल	महापुरुषको संगत

कविता :

लेखनाथ पौडेल	नैतिक दृष्टान्त
पारिजात	मानुषी
गोपाल प्रसाद रिमाल	आमाको सपना
माधव प्रसाद घिमिरे	नेपालै नरहे

नाटक :

विजय मल्ल	बहुला काजीको सपना

- मोहनराज शर्मा, शब्दरचना र वर्ण (विन्यास वाक्यत्तत्व र अभिव्यक्ति, काठमाण्डौ बुक सेन्टर, काठमाण्डौ ।
- चित्र कूमार गुरुé एम्.एस्सी.र केदार न्यौपाने एम्.ए., प्राविधिक शब्दार्थावली (चिकित्सा तथा विज्ञान खण्ड¬), त्रिभुवन विश्वविद्यालय, चिकित्सा शाश्त्र अध्ययन संस्थान, अनुसन्धान शाखा, महाराजगंज, काठमाण्डौ ।
- हेमाéराज अधिकारी, समसामयिक नेपाली व्याकरण, विद्यार्थी पुस्तक भण्डार, भोटाहिटी, काठमाण्डौ ।
- त्रि.वि. पाठ्यक्रम विकास केन्द्र, अनिवार्य नेपाली शिक्षण निर्देशन, काठमाण्डौ ।
- लालानाथ सुवेदी र डा.हरि प्रसाद पराजुली, नेपाली वर्णविन्यास, साझा प्रकाशन, ललितपुर ।
- लालानाथ सुवेदी, अनिवार्य नेपाली अभ्यास पुस्तिका, टङ्कित सामग्री ।
- गोरखापत्र, कान्तिपुर आदि पत्रिकाका सम्पादकीय, टिप्पणी र लेखहरु ।

अन्तिम लिखित परीक्षा मुल्याकन योजना

एकाई	**१**	**२**	**३**	**४**	**५**	**६**	**७**	**जम्मा**
एकाई घण्टा	१०	२०	२०	१०	४	८	३३	१०५
अंकभार	८	१५	१५	८	३	६	२५	८०

ENGLISH

Total: 3 hours /week
Lecture: 3 hours/week
Tutorial: 0 hour/week
Practical: 0 hours/week
Lab: 0 hours/week

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

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

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

Part 1: Language Development **63hrs.**

Unit 1: What are you like? **4 hrs.**

- Reading Comprehension: Finding the real you
- Vocabulary: Character Adjectives (Mature, decisive, motivated)
- Grammar: Review of Tenses
- Writing a formal letter
- Project Work: Write a formal letter of application for a vacancy of health worker precisely describing yourself.

Unit 2: Health Matters **6 hrs.**

- Reading Comprehension: An Unhealthy Obsession
- Vocabulary: Health and Wellbeing
- Grammar: Direct and Indirect Speech
- Writing an academic essay: Introduction
- Project work: Write the first paragraph of academic essay on assigned topic

Unit 3: Looking Ahead **4 hrs.**

- Reading Comprehension: Destination Mars!
- Vocabulary: Phrasal Verbs with *Up* and *Down*
- Grammar: Future Forms
- Writing: Body Paragraph of an academic essay

- Project work: Write body paragraphs for assigned topic

Unit 4: It´s a crime **8 hrs.**

- Reading Comprehension: Writing crime fiction
- Vocabulary: Crime and Punishment
- Grammar: Passives
- Writing: Conclusion of an academic essay using linking phrases
- Project work: Write a five-paragraph academic essay on assigned topic

Unit 5: Buying and Selling **6 hrs.**

- Reading Comprehension: The appeal of eBay
- Vocabulary: Expressions with business and shopping
- Grammar: Making Wishes
- Writing: A Report
- Project Work: Write a report of a recent excursion from your college

Unit 6: Family **4 hrs.**

- Reading Comprehension: Family
- Vocabulary: Family related terminologies
- Grammar: Root words and prefixes
- Writing: An Informal Letter / Email / Correspondence letter
- Project Work: Write an email to your brother/ sister living abroad

Unit 7: Sports **7 hrs.**

- Reading Comprehension: Euro 2020
- Use of sports related terminologies
- British and American Pronunciation
- Writing a news story
- Write a news story on the assigned topic

Unit 8: Education **8 hrs.**

- Reading Comprehension: A Story of My Childhood
- Use of terminologies of Education
- Expressing the degrees of Certainty
- Writing a memo
- Project Work: Write a memo for your college friends reminding them about participation in sports week.

Unit 9: Humor **8 hrs.**

- Reading Comprehension: Why do we laugh inappropriately?
- Synonyms and antonyms of verb: 'laugh'
- Giving Advice: Models (Should/ would / could)
- Writing advice slips/ prescription
- Project Work: Write an advice slip on first aid of a deep cut.

Unit 10: Hobbies **4 hrs.**

- Reading Comprehension: On Walking
- Finding words in dictionary
- Arranging words in alphabetical order
- Keeping a daily diary/ Journal
- Project Work: Share your daily journal to the class friends

Unit 11: Globalization, Diaspora and Diversity **4 hrs**

- Reading-Identity Crisis in *Seasons of Flight*
- Vocabulary: Homophones (Principal/ Principle)
- Writing: Book Review
- Grammar: Prepositions of Time and Place
- Project Work: Write a review of a book you have recently read and present it in class.

Section 2: Literature **42 hrs.**

Unit 12: Short Stories **12hrs**

- The Use of Force – William Carlos Williams
- A Respectable Woman - Kate Chopin
- A Devoted Son - Anita Desai
- The Last Lesson - Alphonse Daudet
- Birth- A. J. Cronin

Unit 13: Poems **12hrs**

- New Nepal- Siddhicharan Shrestha
- A Day - Emily Dickinson
- Every Morning I Wake - Dylan Thomas
- The Parrot in the Cage- Lekhanath Poudyal
- Childhood- Kevin Young
- Lunatic – Laxmiprasad

Unit 14: Essays **12hrs**

- On Libraries - Oliver Sacks
- Marriage as a Social Institution - Stephen L. Nock
- Journey to the End of the Earth- Tishani Joshi
- The Six-Million Dollar Man- Harold J. Morowitz
- Stay Hungry, Stay Foolish! - Steve Jobs

Unit15: Play **6hrs**

- Malini- Rabindranath Tagore

References Books:

- Grade 12 English, Center for Curriculum Development of Nepal, Sanothimi 2077
- Thapa Manjushree Season Of Flights Penguin Books India 2010
- Gude, Kathy and Mary Stephens. Cambridge English Advanced Result. Cambridge, Oxford University Press, 2015.
- Panday, Ram Kumar. *Yeti Tells.* SajhaPrakashan.3rd edition. Kathmandu, 2050.
- Ancient Tales.Ed, Lohani, Shreedhar P, Adhikari Rameshwar P and Subedi, Abhi N. Educational Enterprises Pvt Ltd: Kathmandu,1996.
- Grade 11 English. Centre for Curriculum Development, Government of Nepal: Sano Thimi, 2077.
- Poudel, R.C., A Manual to Communicative English, K.P. Pustak Bhandar, Kathmandu, 1956/57.
- Shah, B.L., A textbook of writing skills in English, First edition Hira Books Enterprises, Kathmandu,
- Fruehling, R. T. and Oldham N. B., Write to the point, McGraw- Hill, Inc. New York NY 10020
- Tayior, G., English conversation practice, 1975.
- Maharjan L. B., A textbook of English sounds and Structures, Vidyarthi Pustak Bhandar, Kathmandu, 2000.
- Better English Pronunciation, Cambridge University Press, New edition
- Link English, Central Department of English, Tribhuvan University

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Total**
Unit hours	4	6	4	8	6	4	7	8	8	4	4	12	12	12	6	105
Marks	3	5	3	6	5	3	5	6	6	3	3	9	9	9	5	80

Social Studies

Total: 2 hours /week
Lecture: 2 hours/week
Tutorial: 0 hour/week
Practical: 0 hours/week
Lab: 0 hours/week

Course Description

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

Course Objectives

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

- Describe the history of Nepal
- Identify the climate, geography, natural resources and administrative units of Nepal.
- Describe the arts and cultural achievements of Nepal.
- Explore the social problems challenging Nepal at present.
- Analyze the salient features of Nepalese economic development.
- Distinguish between democratic and non-democratic forms of government.
- Examine the features of the constitution of the Federal Democratic Republic Nepal, 2047 (1990) and 2072 (2015).
- Mention the chief characteristics of Nepal's foreign policy.
- Describe Nepal's role in the peace-keeping efforts of the world
- Summarize the political development in Nepal.

Course Content:

Unit 1: History of Nepal **20 hrs**

Sub-Unit 1.1: The land of Nepal

- Geographical locations, diversities, and unique characteristics of Nepal. Geographical divisions of Nepal:
    - Ecologic
    - Climatic
    - Rivers
    - Vegetation
    - Administrative units
    - Natural resources of Nepal (general introduction).
    - Patterns of land use in Nepal.

Sub-Unit 1.2: Ancient and Modern Period of Nepal

- Ancient Nepal:

    - Origin of the word "Nepal"
    - Civilization of Kathmandu Valley
    - Malla period and Social Reform
- Rana rule of Nepal:
    - Cultural development
    - Rise and fall of Rana
    - Development of Education in Rana Rule

Sub-Unit: 1.4 Educational Development

- History of Education from ancient to modern period.
- Political, and social factors influencing educational development in Nepal
- Different roles of technical vocational education and general education.
- Policy gap, educational reforms, schooling curriculum.

Sub-Unit 1.5: Peoples' Movements and Rise of Democracy

- The first elected government of Nepal in 2015.
- People's movement of 2046 BS (1990 A.D).
- Comparative study of the characteristics of the constitution of 2047 and the Federal Democratic Republic Nepal (2072) B.S.
- Second people's second movement 2062/063

Unit 2: Society & Culture **15hrs**

Sub-Unit 2.1: Development of Nepalese culture and society

Population growth in Nepal

- Contributing factors of population growth: fertility. Mortality, and migration.
- Caste beliefs and constitutional provisions.
- Establishment of national languages
- Ethnic languages and culture:
    - Nepali
    - Newari
    - Sanskrit
    - Maithili

Social Problems:

- Poverty
- Gender issues
- Unemployment
- Prostitution
- Child labor

- Drug addictions
- Trafficking
- Brain drains

Sub-Unit 2.2: Tourism and Heritage
Food habits Cultural heritages in Himalayan, Hilly and Terai regions

- Dress and ornaments
- Festivals and temples
- Music, songs and dances
- Occupations
- Paintings, sculpture and architecture in ancient, medieval and modern times.
- Mountaineering
- Rafting
- Trekking

Unit 3: Nepalese Economy: 10hrs

Sub-Unit 3.1: Resources and development

Affecting factors for the Nepalese economy poverty.

- Inequality
- Population growth
- Unemployment
- Inclusion.

Features of the Nepalese economic system

- Agriculture and land reform system
- Industrial development
- Internal and external trade
- Tourism
- Cooperation
- Business model

Sub-Unit 3.2: Natural Resources

Resources of National Development

- Human capital
- Forests
- Land
- Water
- Social Capital

Unit 4: Politics and Government 20hrs
Sub-Unit 4.1: Democratic constitution

- Meaning and definition of democracy;
- Characteristics of democratic government;
- Features of the constitution of 2047 and 2072 BS.

Sub-Unit 4.2: Federalism

Structure of the state

- Federal
- Provincial
- Local

Distribution of state power

- Federation
- Province
- Local
- Legislative
- Federal Parliament (House of Representatives and National Assembly)

Composition, power and functions
Executive: Federal Executive (Council of Ministers)
Composition, power and functions

- Judiciary: Courts
- Supreme court
- Appeal court
- District court

Composition, power and functions of Judiciary
President and Vice President:

- Functions, duties and Authorities
- Fundamental rights and duties of the citizen/people

Sub-Unit 4.3: Provincial Legislature and Provincial Executive
Local Legislature and local executive
Local legislature

- Village Assembly,
- Municipal Assembly

Local Executive

- Village executive and municipality
- District Assembly and District Coordination Committee
- Interrelationship between the Federation, provinces and local level

Unit 5: Foreign Policy **5hrs**

Nepal's foreign policy

- Geographical
- Historical
- Cultural
- Economic
- International

Features of Nepal's foreign policy

- Non-aligned
- Pancasila
- Acceptance of UNO charter
- Regional cooperation
- Peace movement

Neighbours Nepal's relations with its

- China
- India

Reference Books:

- Jagadamba Press, Faces of Nepal
- Bista, Dor Bahadur, People of Nepal
- Bista Dor Bahadur, Sabai Jatko Fulbari
- TVET policy 2015, Ministry of Education Science and Technology, Singadurbar Kathmandu Nepal
- Shrestha Siddhishwor Man & Shrestha Savitri, Social Studies, Akshalok Publication, 2071.

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**Total**
Unit hours	20	15	10	20	5	70
Marks	11	9	6	11	3	40

Anatomy and Physiology

Total: 4 hours /week
Lecture: 4 hours/week
Tutorial: 0 hour/week
Practical: 0 hours/week
Lab: 0 hours/week

Course description
This course provides basic knowledge of the normal structure and function of the systems of the human body. The content prepares the student to understand how the body system works together and its relation among all body systems.

Objectives
After completion of this course the student will be able to:

- Identify the different structure of the human body, including the various systems and their components
- Describe how the body's systems and organs function and interact to maintain homeostasis and overall health of the human body.
- Explain the interrelationship of the body systems.
- Explain the physiology of different systems.

Unit 1: System Approach to the Human Body **10 hrs.**

- Definition of Anatomy, physiology; various suffix and prefix used in anatomy and physiology
- Define different terminologies used in various systems
- Main cavities: Cranial, thoracic, abdominal, and pelvic.
- Anatomical position of the body: anterior, posterior superior, inferior, proximal, distal, dorsal, ventral, palmer, lateral, supine, prone, Range of motion: Flexion, extension, abduction, adduction, rotation, circumduction, supination, pronation, opposition,

Unit 2: Introduction to cells and tissues **8 hrs.**

- The structure and functions of human cell
- Cell division: Mitosis, Meiosis
- The structure and function of tissues: Epithelial tissue, connective tissue, muscular tissue, nervous tissue
- Structure and functions of membranes, gland, cartilage

Unit 3: Body Fluid and Electrolyte **20 hrs.**

- Body fluid and electrolyte
  - Fluid and electrolyte distribution
    - Intracellular fluid
    - Extracellular fluid
  - Important function of body fluid
  - Body fluid and electrolyte balance

- Importance of fluid and electrolyte balance in health
- Acid base balance
  - Definition of acid and base
  - Mechanism to maintain acid base balance
  - Respiratory system
  - Urinary system
  - Buffer mechanism
- Fluid and electrolyte imbalances
  - Different conditions related to fluid and electrolyte imbalance
    - Dehydration/ Over hydration
    - Hypo/Hyperkalemia
    - Hypo/Hypernatremia
    - Hypo/Hypercalcemia
    - Hypo/Hypermagnesemia
    - Ways of replacement
    - Oral rehydration therapy
    - Naso-gastric feeding
    - Intravenous therapy: Types of rehydration solution
      - Hypertonic
      - Hypotonic Isotonic

Unit 4: Introduction to Circulatory System **10 hrs.**

- Circulatory system
  - Structure and functions of heart
  - Cardiac cycle
  - Conduction system
  - Heart sound
  - Normal blood flow
  - Blood
    - Composition of blood: Cells, Plasma, Coagulation factors
    - Functions of blood
    - Blood grouping and Rhesus factor
- Blood Vessels
  - Structure and Function of blood vessels
  - Main blood vessels and their branches
  - Blood Pressure
  - Pulse
- Different kinds of circulation
  - Pulmonary circulation
  - Systematic circulation
  - Portal circulation
  - Fetal circulation

Unit 5: Introduction to Lymphatic System **8 hrs.**

- Structure and function of lymphatic system

- Lymphatic vessels
- Lymphatic organs and tissue
    - Lymph nodes
    - Spleen
    - Thymus
    - Tonsils/ Peyer's patches
    - Immunoglobulin and its types

Unit 6: Introduction to Muscular System **8 hrs.**

- Types, structure and functions of muscles
    - Voluntary
    - Involuntary
    - Cardiac
- Principal skeletal muscle
    - Muscles of the face, neck, trunk, shoulder and upper limb, hip and lower limb, pelvic floor
    - Action of the muscles in relation to force

Unit 7: Introduction to Skeletal System **10 hrs.**

- Definition: Bone, Joint
- Development of bone
- Suture and fontanelles
- Types and function of Bones
    - Long/short/flat/irregular/sesamoid
- Classification of skeleton
    - Axial/ Appendicular
- Types and function of joints
    - Fixed/cartilaginous/synovial
    - Mechanism of joint movement and its relation to the principles of lever
- Types/structure/functions of teeth
    - Temporary/ Permanent
- Types of movement of bones
- Types of sinuses
    - Frontal/sphenoid/Ethmoid /Maxillary
    - Disorders (Introduction only)
    - Osteoporosis, Rickets, Osteomalasia, Osteomylitis, Piget's disease, Tumors of bone, Arthritis, Carpel Tunnel syndrome
    - Fracture

Unit 8: Introduction to Respiratory System **10 hrs.**

- Structure and function of different parts of respiratory organs

- Nose and nasal cavity, Sinuses, Pharynx, Larynx, Trachea, Lungs, Bronchi and Bronchioles, Alveoli
- Respiratory muscles: Intercostal muscle and Diaphragm
- Physiology of respiration
    - External respiration
    - Internal respiration
    - Exchange of gases
    - Respiration in relation to Boyle's law
- Capacity of lung: tidal volume, inspiratory reserve volume, Inspiratory capacity, functional residual capacity, Expiratory reserve volume, residual volume, vital capacity,

Unit 9: Introduction to Digestive System **6 hrs.**

- Definition
    - Digestion
    - Digestive system
- Structure and function of digestive organs involved in digestive system: Mouth, Oesophagus, Stomach, Small intestine, Large intestine, Rectum, Anus
- Structure and function of and its accessory organs: Pairs of salivary glands, pancreas, liver, biliary duct
- Types/structure/functions of teeth
    - Temporary/ Permanent
- Functions of digestive system
- Physiology of digestion

Unit 10: Introduction to Urinary System **8 hrs.**

- Structure and function of organs related to urinary system
    - Kidney
    - Ureter
    - Urinary bladder
    - Urethra
- Composition and mechanism of urine formation
    - Glomerular filtration
    - Selective reabsorption
    - Tubular secretion
- Mechanism of micturition

Unit 11: Introduction to Nervous System **8 hrs.**

- Introduction, nerve, neuroglia, synapse, nerve transmission
- Types of nerves
- Mechanism of stimuli transmission
- The central nervous system

- Covering membrane (meninges)
- Cerebrum
- Mid brain
- Cerebellum
- Brain stem
- Ventricles
- Spinal cord

- The peripheral nervous system
  - Spinal nerve
  - Cranial nerve
  - Autonomic nervous system
- Neurons'
  - Mechanisms of stimuli transmitted in the nervous system –Reflex action
    - CNS- Brain and Spinal cord
    - PNS-Spinal cord and cranial nerves
    - ANS- Sympathetic and parasympathetic system

Unit 12: Introduction to Reproductive System **10 hrs.**

- Female reproductive organ
  - Structure and functions of external and internal reproductive organs.
  - Primary and secondary sex characteristics
  - Mechanism of:
    - Puberty
    - Menstruation cycle.
    - Fertilization: Spermatogenesis, Oogenesis, Conception
  - Menopauseh
- Structure and function of mammary gland
- Male reproductive organs
  - Structure and function of male reproductive organs
  - Primary and secondary sex characteristics
  - Puberty

Unit 13: Introductions to Endocrine System **10 hrs.**

- Structure and function of endocrine glands and its hormones
- Hormone produced by different glands and its functions
- Male and female sex hormones
  - Estrogens
  - Progesterone
  - Testosterone
  - Other hormones

Unit 14: Introductions to Special Sensory Organ **6 hrs.**

- Structure and function of the skin

- Sensation
- Regulation of body temperature:
- Conduction
- Convention
- Radiation
- Excretion

- Protection of body structure and immunity
- Sensory organ: Eye
  - Location of the eye
  - Structure and function of the eye
  - Eye accommodation
  - Visual pathway
- Structure and function of Ear (Adult and Child)
  - Location of the ear
  - Structure of the ear
  - Function of the ear
- Nose and Throat: Structure and function (Review from respiratory system)
- Tongue: Structure and function (review from digestive system)

Unit 15: Human Growth & Development **8 hrs.**

- Foetal circulation and neonatal changes.
- Characteristics of the stages of life development:
  - Neonatal
  - Infancy
  - Childhood
  - Adolescence
  - Adulthood
- Causes of aging.

References Books: -

- Wangh and Grant, A, Ross and Wilson. Anatomy and Physiology in Health and Illness 2nd ed. (2006): Churchill Livingstone Elsevier.
- Tuitui R, Suwal SN (2018). Human Anatomy and Physiology. Vidharthi Publication, Bhotahity, kathmandu
- Anotomy & Physiology, Surya Publication, Kathmandu
- Chevalking H, Tuladhar K, Shrestha U. Integrated Science Related to Health, (2005); HLMC, IOM.
- Windood, R.S., Sear's. Anatomy and Physiology for Nurses (1985): English Language Book Society.
- Textbook of Anatomy & Physiology, Akshav Publication.

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Total**
Unit Hours	10	8	20	10	8	8	10	10	6	8	8	10	10	6	8	140
Marks	6	5	10	6	5	5	6	6	2	5	5	6	6	2	5	80

Physics (Theory)

Total: 6 hours /week
Lecture: 4 hours/week
Tutorial: 0 hour/week
Practical: 0 hours/week
Lab: 2 hours/week

Course Description

This course in physics is designed to provide students with an understanding of the scientific laws of our physical world and how physics contributes 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 component of this course is designed to supplement learning through the application of learned theory. The students will handle simple apparatus to do simple measurements, demonstrate simple electrical circuits, and apply their knowledge of physics to real life examples.

Course objectives

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

- Correlate physics and its applications 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 knowledge of physical principles to familiar and unfamiliar situations.
- Apply facts, vocabulary and conventions to unit measurements and common measuring instruments.
- Explain the definitions, laws, concepts, theories and models presented in this course.
- Describe the applications and implications of physical facts and principles.

Course Content

Unit 1: Mechanics **30 hrs.**

Sub-unit 1.1: Units and Measurement

- Physical concept of mass, length and time.
- Various systems of units and their conversion.
- Express derived units in terms of fundamental units.
- Precise and accurate measurement
- Dimensional formula for various physical quantities.
- Conversion of system of units using dimensions
- Simple numerical problems

Sub-unit 1.2: Scalar and Vectors

- Scalar and vectors quantities.
- Vector addition by parallelogram and triangle method.
- Resolve a vector into two components.
- The product of two vectors.
- Simple numerical problems

Sub-unit 1.3: Kinematics

- 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

Sub-unit 1.4: Force

- Newton's laws of motion.
- Interpret the meaning of inertia of rest and inertia of motion.
- Applications of inertia and impulse.
- Angular displacement, velocity and acceleration
- Relation between linear and angular velocity.
- Centripetal force and centrifugal force.
- Derivation of centripetal force.
- Friction, limiting friction, angle of friction and coefficient of friction.
- Laws limiting friction.
- Relation between angle of friction and coefficient of friction.
- Simple numerical problems

Sub-unit 1.5: Work, Energy and power

- Work, energy and power.
- Conservation of energy for freely falling body.
- Transformation of energy
- Simple numerical problems

Sub-unit 1.6: Gravity and Gravitation

- Laws of gravitation.
- Acceleration due to gravity, mass and weight
- 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.
- Conditions of equilibrium.
- Simple numerical problems

Sub-unit: 1.7 Properties of Matter

- Hook's law
- Stress, strain and elasticity of solid material
- Elastic potential energy and energy density in a stretched wire (without derivation)
- The property of surface tension of liquid.
- Adhesive and cohesive forces.
- The capillary action.
- Viscosity and fluid movement
- Simple numerical problems

Sub-unit 1.8: Hydrostatics

- Fluid pressure
- Pascal's law.
- Density, relative density and specific gravity.
- Difference between density and specific gravity.
- Archimedes' principle
- The principle of floatation and condition of equilibrium for floating bodies.
- Atmospheric pressure
- The effect of air pressure on the human body.
- Simple numerical problems

Unit 2: Heat **15 hrs.**

Sub-unit 2.1: Thermometry

- Concept of heat and temperature.
- Types of thermometers
- Relation between different temperature scales.
- Simple numerical problems

Sub-unit 2.2: Expansion

- Linear, superficial and cubical expansion of solids.
- Derivation of $\Upsilon = 3\prec$ and $\beta = 2\prec$.
- Apparent and real expansion of a liquid and its relation
- Change in density of an object due to change in temperature.
- Anomalous expansion of water.
- Simple numerical problems.

Sub-unit 2.3: Calorimetry

- Heat capacity and specific heat capacity.
- 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 and latent heat of steam by the method of mixture.
- Simple numerical problems

Sub-unit 2.4: Hygrometry

- Saturated and unsaturated vapours and their pressures.
- P-V and P-T diagrams and explain the behaviour of vapours.
- The effect of pressure and altitude on the boiling point of a liquid.
- Wet and dry bulb hygrometer and relative humidity.

Sub-unit 2.5: Transfer of heat

- The method of heat transfer by conduction, convection and radiation.
- Thermal conductivity.
- Black body and black body radiation.
- Stefan's law of black body radiation.
- Medical uses of heat radiation (thermal therapy)
- Simple numerical problems

Unit 3: Light **10 hrs.**

Sub-unit 3.1: Reflection of light

- Reflection and laws of reflection of light.
- Principle of rotation of mirror.
- Real and virtual image.
- Image formation of spherical mirror.
- Nature, size and position of the image formed by spherical mirrors.
- Simple numerical problems

Sub-unit 3.2: Refraction

- Refraction and laws of refractions
- Refractive index
- Real depth and apparent depth.
- Lenses and lens formula
- Lens Maker's formula

Sub-unit 3.3: Optical Instrument

- Structure of human eye.
- Defects of vision and their correction.
- Use of simple and compound microscopes.
- Calculation of the magnifying power of simple and compound microscopes.
- Dispersion of light by prism.
- Simple numerical problems

Unit 4: Waves and Sound **10 hrs.**

Sub-unit 4.1: Waves

- Longitudinal and transverse waves.
- Equations of progressive and stationary waves
- Superposition of waves
- Reflection, refraction, diffraction, and interference of waves
- Simple numerical problems

Sub-unit 4.2: Characteristics of Sound Waves

- Velocity of sound in air (Newton's formula and Laplace's correction)
- Factors affecting velocity of sound.
- The characteristics of sound (note, pitch, intensity, loudness and timber)
- Overtones and quality of sound.
- Beat and beat frequency.
- Intensity level in terms of decibels.
- Threshold of hearing and threshold of pain.
- Ultrasonic wave and its medical uses.
- Simple numerical problems

Unit 5: Electrostatics **15 hrs.**

Sub-unit 5.1: Fundamentals of electrostatics

- Charges and their properties.
- Electrification by friction, conduction and induction on the basis of modern theory.
- Surface charge density
- Simple numerical problems

Sub-unit 5.2: Electrostatic Field

- Coulomb's law in electrostatics
- Dielectric constant (Permittivity) in a medium
- Electric field and normal electric flux
- Potential and potential energy (no derivation)
- Analogy between electric potential and gravitational potential.
- Concept about zero potential
- Capacitor and Capacitance
- Parallel Plate capacitor
- Series and Parallel grouping of capacitors
- Electron volt and its use
- Simple Numerical problems

Unit 6: Magnetism **15 hrs.**

Sub-unit 6.1: Fundamentals of Magnetism

- Geometrical and effective length, magnetic moment, Pole strength of magnet.
- Coulomb's law for magnetism.
- Magnetic field intensity due to bar magnet at end on position (b) broad side on position.
- Magnetic lines of force
- Neutral point
- Simple numerical problems

Sub-unit 6.2: Terrestrial Magnetism

- Dip, declination, horizontal and vertical components of earth's magnetic field.
- Properties of Dia, para and ferromagnetic
- Domain theory of ferromagnetism.
- Simple numerical problems

Unit 7: Current Electricity **20 hrs.**

Sub-unit 7.1: Electric current

- Current as the rate of flow charge.
- Potential difference.
- Ohm's law and its verification.
- Resistance and resistivity
- Series and parallel combination of resistances
- Galvanometer and its conversion into ammeter and voltmeter.
- Ohmic and non-Ohmic conductors.
- Various types of electrical circuits.
- Simple numerical problems

Sub-unit 7.2: Resistance and heat

- Joule's laws of heating
- Heat production in resistance wire due to passage of current.
- Meaning of Joule’s conversion factor.
- Emf, terminal potential difference, internal resistance and their relation.
- Electric power, watts, kilowatts, kilowatt-hour and horsepower.
- Simple numerical problems

Sub-unit 7.3: Chemical effect of current

- Faraday's laws of electrolysis.
- Faraday's constant and electrochemical equivalent.
- Thermoelectric effect and its verification, thermocouple
- Neutral point and temperature of inversion.
- Peltier effect.

Sub-unit 7.4: Alternating Current

- AC and DC.
- Relation between rms and mean value of current and voltage with its peak value. (Derivation not required)
- Merits and demerits of AC and DC.
- Introduction of a transformer and energy loss mechanisms in transformers.
- Faraday's law of electromagnetic induction.

Unit 8: Modern Physics **25 hrs.**

Sub-unit 8.1: Electron

- Particle nature of electricity.
- Production and properties of cathode rays.
- Motion of electron in electric and magnetic fields.
- Specific charge of an electron (introduction)
- Simple numerical problems

Sub-unit 8.2: Photoelectricity

- Photoelectric effect.
- Quantum theory of radiation.
- Einstein's photoelectric equation
- Stopping potential
- Photocells
- Simple numerical problems.

Sub-unit 8.3: X-ray

- Production, nature and use of x-rays.
- X-ray diffraction (Introduction)
- Simple numerical problems

Sub-unit 8.4: Radioactivity

- Radioactivity.
- Properties of □, □ and □ radiations.
- Laws of radioactive disintegration and derivation of decay equation.
- Relation between half-life and decay constant.
- Radio-carbon dating
- Medical uses of radiation and artificial radioactive nuclei.
- Simple numerical problems.

Sub-unit 8.5: Properties of nucleus

- Nucleus and its properties.
- Isotopes, isotones
- Mass defect, binding energy and their relation.
- Binding energy curve
- Nuclear Fission and nuclear fusion reaction
- Einstein's mass energy relation
- Radiation hazards and safety.
- Biological effect of nuclear radiations
- Simple numerical problems

Sub-unit 8.6: Physics and Society

- Deteriorating conditions of the environment we live in.
- Useful and harmful aspects of radiation.
- Concepts about ozone depletion, greenhouse effect and acid rain.
- Environmental protection strategies

Reference Books

- Brij Lal and Subramanyan, Principles of Physics.
- Nelkon and Parker, Advanced Level Physics (5th ed.)
- Advance Physics, Surya Publication, Kathmandu
- Physics Practical Manual, Basanta Raj Rosyra (second edition)
- Pradhan, J.M. & Gupta, S.K., A Textbook of Physics (part I & II)
- Verma, H.C., Concepts of Physics I & II

- Sears, Zemansky & Young, University Physics
- Halliday, D & Resnick, R., Physics Part I & II
- Textbook of Physics Akshav Publication

Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Unit hours	30	15	10	10	15	15	20	25	140
Marks	16	9	6	6	9	9	11	14	80

Physics (Practical)

Practical: 70 hrs.

- Determine the volume of a hollow cylinder and a solid cylinder using vernier calipers.
- Determine the volume of a steel ball or glass rod using a micrometer screw gauge.
- Determine thickness of glass plate using spherometer.
- Determine the acceleration due to gravity by using simple pendulum.
- Demonstrate Archimedes' principle and find the specific gravity and density of solids heavier than water and insoluble in water
- Determine the specific gravity and density of substances lighter than water and insoluble in water
- Demonstrate the Verification the laws of reflection of light and find the relationship between object distance and image distance.
- Determine the refractive index of liquid/glass slab using travelling microscope.
- Draw ID curve through the prism and find the refractive index of prism.
- Determine the upper and lower fixed points of a given thermometer and find the correct temperature of tap water.
- Determine the focal length of a convex lens by the double pin method.
- Demonstrate the Verification of the laws of moments of forces and find the weight of a given body.
- Determine the latent heat of fusion of ice by mixture method.
- Determine the melting point of wax by cooling curve method.
- Determine the magnetic moment and pole- strength of a bar magnet by locating the neutral points, keeping N-pole pointing south
- Determine the magnetic moment and pole- strength of a bar magnet by locating the neutral points, keeping N-pole pointing north.
- Determine unknown resistance of wire by using the concept of Ohm's law
- Demonstrate the variation of lateral displacement with an angle of incidence in a rectangular slab.
- Determine the refractive index of a prism using the I-D curve method.
- Determine velocity of sound in air at NTP using resonance tube apparatus
- Determine angle of dip in the laboratory
- Determine frequency of AC source using sonometer
- Demonstrate for Verification of the laws of rotation of light.

Chemistry (Theory)

Total: 6 hours /week
Lecture: 4 hours/week
Tutorial: 0 hour/week
Practical: 0 hours/week
Lab: 2 hours/week

Course Description

This course is an introductory course designed for the students specializing in Health Science and has two parts: theoretical and practical. The theoretical part consists of different units of general or physical chemistry, inorganic chemistry, and organic chemistry - Structure of atom, Chemical bonding, Acids and Bases, Periodic table, Redox reactions, Metals and metallurgy, Principles qualitative analysis, Structure and properties of organic compounds, Alkanes, Alkenes, Alkynes, Aromatic hydrocarbons, Stereoisomerism, Solution, Chemical kinetics, Catalysis, Colloids, Chemical equilibrium, Ionic equilibrium. In the practical part, the different experiments to be performed are listed in the practical course. The students are required to secure pass marks in theory as well as practical course separately. Emphasis is given to the principles related to chemistry within everyday life and to the application of chemistry in health science.

Course Objectives:

The general objectives of this course are as follows:

- Provide students with general knowledge and basic aspects of physical, organic, and inorganic chemistry.
- Inculcate the knowledge and skills of chemistry through learning experience and practical activities.
- Provide students with an opportunity to understand enquiry-based chemistry with its application in various fields.
- Prepare report on practical record file using appropriate methods and approaches.
- Provide students with hands on and mind on experience chemistry processes, skills and tools.
- Interpret the nature and fundamentals of chemistry in health science.
- Assist the students to know about the importance of chemistry and their role in body mechanism.
- Familiar with the sources, effects, chemicals present in the atmosphere and control measures of environmental pollution.

Unit 1: Physical and General Chemistry **60hrs**

Subunit 1.1. Introduction to Chemistry (foundation and fundamentals) **4 hrs**

- General introduction to chemistry.
- Importance and scope of chemistry.
- Element and compound.
- Atoms, Molecules, Symbol and Formula (Molecular formula, empirical formula)
- Radical and percentage composition from molecular formula.

- Chemical equation, reactant and product.
- Significance and limitations of chemical equations.
- Types of chemical reactions (seven-types) with examples.
- Balancing a chemical equation by:
  • Hit and trial method
  • Partial equation method (To build up concept only: reactions involving nitric acid)

Subunit 1.2. Stoichiometry **5 hrs**

- Dalton's atomic theory
- Atomic weight, atomic mass unit(amu) and gram atomic weight
- Molecular weight and gram molecular weight
- Laws of stoichiometry (statement and example only, no numerical calculations)
- Avogadro's hypothesis. (Deduce relation between molecular mass and VD)
- Mole concept, Mole in the term of mass, volume and no. of atoms/molecules.
- Relationships based upon chemical equations.
- Mass – mass relationship, mass – volume relationship, volume – volume relationship.
- Limiting reagent.
- Simple Calculation of related numerical problems.

Subunit 1.3. Atomic Structure **4 hrs**

- Sub-atomic particles (Charge and mass)
- Rutherford's nuclear model of atom
- Bohr's atomic model
- Bohr's explanation of hydrogen spectrum
- Aufbau's principle
- Hund's rule.
- Atomic number, mass number, Isotopes and isobars.

Subunit 1.4. Classification of elements and their periodic properties **5 hrs**

- Modern periodic law and modern periodic table.
- Classification of elements into different groups, periods and blocks.
- Nuclear charge and effective nuclear charge.
- Periodicity and periodic trend of periodic properties of elements (general trend only):
- Atomic radii (ionic and covalent)
- Ionization potential
- Electron affinity
- Electronegativity

Subunit 1.5. Chemical bonding **3 hrs**

- Electronic theory of valency
- Types of chemical bond and their properties: Electrovalent, Covalent, Co-ordinate covalent Polarity in covalent bond, Hydrogen bond and its consequences, (solubility, viscosity and boiling point)

Subunit 1.6. States of matter - Gaseous state **4 hrs**

- Kinetic theory of gases. (Postulates only)
- Boyle's law & Charles' law (with graphical representation)
- Ideal gas equation.

- Dalton's law of partial pressure
- Graham's law of diffusion.
- Simple numerical calculations

Subunit 1.7. States of matter - Liquid state 6 hrs

- Physical Properties of liquids: evaporation and condensation
- Vapour pressure and boiling point.
- Surface tension and viscosity.
- Rault's law
- Solution (Unsaturated, saturated and supersaturated solution)
- True solution, solubility, solubility curve
- Henry's law
- Osmosis, osmotic pressure, isotonic, hypotonic and hypertonic solution
- Biological importance of osmosis.
- Colloids; lypophilic and lypophobic colloids,
- Tyndal effect
- Brownian movement (simple concepts)
- Coagulation
- Electrophoresis
- Dialysis emulsion, gels, and gelation
- Application of colloids in medical field and in daily life.

Subunit 1.8. States of matter - Solid state 1 hrs

- Types of solids; amorphous and crystalline solids, Efflorescent, deliquescent and hygroscopic solids
- Crystallization and water crystallization. Molecular crystal, Covalent crystal, Ionic crystal

Subunit 1.9. Oxidation and Reduction 4 hrs

- Classical concept of oxidation and reduction.
- Electronic concept of oxidation and reduction.
- Oxidant and reductant and oxidation number
- Examples of redox reaction.
- Balancing the chemical equation by oxidation number method and ion electron method.

Subunit 1.10. Acid, Base and Salt 3 hrs

- Arrhenius theory of acid base, Bronsted-Lowery (conjugate acid-base pair) theory and Lewis's concept
- Salts and their types.
- Antacids and anta bases and their medical uses.

Subunit 1.11. Electro Chemistry 5 hrs

- Electrolytes, non-electrolytes, strong and weak electrolytes.
- Arrhenius theory of ionization.
- Faradays' laws of electrolysis.
- Electrolysis of water, Ionic product of water, PH, POH, Buffer solution
- Importance of PH and buffer in human body.
- Simple numerical problems based on Faradays' laws only

Subunit 1.12. Volumetric analysis 5 hrs

- Equivalent and gram equivalent weight of Element, Determination of equivalent weight of metal by hydrogen displacement method
- Acid, base, and salt Titration

- Acidimetry, alkalimetry, end point, indicator, primary and secondary standard substance
- Ways of expressing concentration of solution in terms of Normality, Molarity, molality % by mass, % by volume, parts per million (ppm), Normality factor
- pH changes in acid base titration and choice of indicator
- Calculations to prepare different concentrations of solutions.

Subunit 1.13. Chemical Thermodynamics 4 hrs

- Introduction
- Enthalpy and enthalpy change, exothermic and endothermic reactions, heat of combustion and its application, heat of formation, heat of neutralization and heat of solution, bond energy.
- First law of thermodynamics
- Hess's law

Subunit 1.14. Chemical Kinetics 7 hrs

- Rate of reaction; average and instant rate of reaction
- Law of mass action and rate equation (Rate law)
- Order and molecularity of reaction
- Zero, First and second order reactions
- Factors affecting rate of reaction
- Collision Theory
- Energy profile diagram for endothermic and exothermic reactions
- Chemical Equilibria and Le-Chateliers' Principle
- Catalysis; Enzyme catalysis, characteristics of enzyme catalysis, promoter, autocatalysis, negative catalysis, catalytic poisoning

Unit 2: Inorganic Chemistry and Environmental Chemistry 35hrs

Subunit 2.1. Hydrogen, Oxygen and Water 7 hrs

- Hydrogen: Isotops of hydrogen, ortho and para hydrogen, Chemical comparison of atomic and molecular
- Hydrogen Oxygen: Types of oxides (acidic, basic, amphoteric, peroxide and mixed oxide), Medical application of oxygen and hydrogen peroxide.
- Water: Introduction of soft and hard water.
- The process of removal of hardness-Boiling,
- Clark's process, using washing soda, permutit process
- Quality of drinking water
- Solvent property of water

Subunit 2.2. Nitrogen 3 hrs

- Laboratory preparation and manufacture (Haber's process) of ammonia. [figure and description not required]
- Physical and chemical properties of ammonia (action with metals, Nessle'; s reagent, ammonia as a Lewis base,basic nature)
- Uses of ammonia

Subunit 2.3. Carbon 2 hrs

- Allotropes of carbon
- Laboratory preparation of carbon monoxide. [figure and description not required]
- Chemical properties in reaction (with O2, Cl2, Ni, NaOH, and hemoglobin)

Subunit 2.4. Phosphorous **2 hrs**

- Occurrence of phosphorous in animal bones, ATP and ADP.
- Properties of white phosphorous reactions with O2, with Cl2, caustic alkali.
- Uses of phosphorus.

Subunit 2.5. Sulphur **5 hrs**

- Laboratory preparation of SO2[figure and description not required]
- Chemical properties of SO2 (action with lime water, sodium carbonate, oxidizing and reducing properties,
- bleaching properties)
- Laboratory preparation of H2S. [figure and description not required]
- Reducing properties and action with cations.

Subunit 2.6. Halogens **4 hrs**

- Laboratory preparation of Cl2, Br2 and I2 [figure and description not required]
- Compare the chemical properties of halogens-
- Oxidizing action, bleaching action, in reaction with H2, with slaked lime, and with organic compounds.
- Uses of Cl2

Subunit 2.7. Metals, metallurgy and minerals **3 hrs**

- Difference between minerals and ores, flux and slag, calcination and roasting.
- Sources of the following minerals- Na, K, Ca, Mg, Fe, Zn, Ni, Cobalt.
- Biological importance and effects due to their deficiency

Subunit 2.8. Metallic Compounds **4 hrs**

- Preparation, properties and uses ofHgCl2, Hg2Cl2, Plaster of Paris, Epsom salt, Bleaching powder, Cu2O,AgNO3, AuCl3, ZnCl2.2H2O

Subunit 2.9. Pollution **5 hrs**

- The sources and adverse effects due to the following air pollutants- CO2, SO2, O3, H2S,CO, hydrocarbon, lead, cadmium dust, CFC, oxides of nitrogen.
- Air pollution and its effects on:
- Human health, material sand climate, Greenhouse effect,
- Ozone layer depletion
- Acid rain and its adverse effects.
- Water pollution and its effects.
- Nuclear and pesticide pollution.

Unit 3: Organic Chemistry **45Hours**

Subunit 3.1. An introduction to Organic compounds **8 hrs**

- Organic chemistry as a separate branch, Reason for large number of organic compounds.
- Difference between organic and inorganic compounds.
- Sources of organic compound
- Functional group and Homologous series
- IUPAC system of Nomenclature of aliphatic compounds containing functional and polyfunctional groups.
- Structural isomerism in organic compounds.
- Free radical, Carbocation and carbanion.
- Inductive effect (+I and –I effect), Significance of inductive effect
- Electrophiles and Nucleophiles.

- Hybridization (sp, sp2 and sp3) and Resonance
- Importance of organic chemistry in medical field
- Structure and uses of simple drugs: Antipyretics, antiseptics, analgesics, antibiotic, antimalarials, tranquilizers, germicides, and fungicides.

Subunit 3.2. Hydrocarbons **6 hrs**

- Saturated and unsaturated hydrocarbons
- Preparation of ethene from ethanol.
- Chemical properties and uses of alkenes.
- Markovnikov's rule and anti-Markovnikov's rule
- Preparation of ethyne from calcium carbide.
- Chemical properties–Combustion, hydrogenation, catalytic hydration, with Br2 solution, with Na, polymerization
- Uses of hydrocarbons

Subunit 3.3. Alkyl Halides **5 hrs**

- General method of preparation and chemical properties of monohaloalkanes
- Substitution reaction; SN1 & SN2(basic concept only)
- Elimination reaction (dehydrohalogenation-Saytzeff's rule)
- Laboratory preparation of chloroform.
- Chemical properties of chloroform
- Iodoform test
- Uses chloroform.

Subunit 3.4. Alcohol **4 hrs**

- Classification and distinction between primary, secondary and tertiary alcohols.
- Fermentation of ethyl alcohol
- Physical and chemical properties of ethyl alcohol (oxidation with sodium, bleaching powder, oxygen, sulphuric acid, phosphorius halides, CH3COOH,)

Subunit 3.5. Aldehyde and Ketones **5 hrs**

- General methods of preparation of aldehydes and ketone: and chemical properties (NH2OH, NH2CONH2, C6H5NHNH2, NH2NH2, NaHSO3; 2,4-DNP, Formaline, Oxidation of ammonia)
- Uses

Subunit 3.6. Carboxylic acid **2 hrs**

- Preparation of carboxylic acid from alcohol, aldehyde and alkyl benzene.
- Physical and Chemical properties (acidic character, NaHSOCl2, NH3,C2H5OH, P2O5)
- Uses

Subunit 3.7. Ethers **2 hrs**

- Laboratory preparation from ethanol.
- Physical properties.
- Chemical properties with-Combustion
- Hydrolysis
- Reaction with excess HI and PCl5.
- Uses in medicine

Subunit 3.8. An introduction to Aromatic Compounds and Benzene 2 hrs

- Introduction
- Aromatic compound.
- Characteristics of aromatic compounds.
- Kekule's structure of benzene
- Preparation of benzene, physical and chemical properties (halogenation, nitration, sulfonation, Freidel Craft's reaction)
- Uses

Subunit 3.9. Phenol 2 hrs

- Introduction
- Preparation of phenol.
- Physical and Chemical properties (action with zinc dust, NaOH, NH3, PCl5, Kolbe's reaction, Condensation with formaldehyde)

Subunit 3.10. Nitrobenzene 2 hrs

- Introduction
- Laboratory preparation of nitrobenzene.
- Physical properties
- Reduction reaction of Nitrobenene in different medium.
- Uses in everyday life.

Subunit 3.11. Aniline 2 hrs

- Introduction
- Laboratory preparation of pure aniline
- Physical and Chemical properties- basic nature, alkylation, acylation, sulfonation, halogenation, nitration
- Uses

Subunit 3.12. Biomolecules 5 hrs

- Carbohydrate:
  - Definition and classification,
  - Structure (Linear /Cyclic) of glucose,
  - Functions of Carbohydrates
- Protein:
  - Amino acid and Peptide bond
  - Essential and non-essential amino acid
  - Denaturation of protein
  - Functions of Protein
  - Enzymes (Definition and importance)
- Lipid:
  - Introduction of lipid, fat and oil and their natural sources.
  - Hydrolysis
  - Functions of fat and oil
- Vitamins and coenzymes:
  - Introduction
  - Fat soluble and insoluble vitamins
  - Importance and function

Reference Books

- Jha, J.S.,&Gugliani, S.K.,A Textbook of Chemistry. Seirya Publication.Current edition.
- Sthapit,M.&Pradhananga, R.R.,Fundamentals of Chemistry (vol. I&II). Taleju Prakashar.Currentedition.
- A text book Chemistry, Surya Publication, Kathmandu
- Pandit, C.N. Dr., Subedi, R.R. and Tiwari, Prakash; A Textbook of Chemistry; K.P. Publication, Dillibazar, Kathmandu.
- Textbook of Chemistry, Akshav Publication.

Final written exam marking scheme

Unit	**1**	**2**	**3**	**Total**
Unit hours	60	35	45	140
Marks	34	20	26	80

Chemistry (Practical)

Practical: 70Hrs

- Procedural rules and guidelines of the chemistry lab.
- Proper handling of equipment.
- Lab safety measures.
- Documentation procedures for laboratory work.
- The correct operation of the Bunsen burner.
- Parts of the Bunsen burner.
- Differentset Oxidizing and non-oxidizing flames.
- Demostrate methods of filtration.
- Chloride ion, sulphate ion and nitrate ion test.
- Nature of mixtures and components.
- Principles and processes of sublimation.
- Principles and process of precipitation.
- The distillation process.
- Crystallization point and crystallization process.
- Acid base reactions.
- process of evaporation.
- Set up the apparatus and prepare hydrogen, nitrogen, ammonia and carbon dioxide gas at lab.
- Chemicals used in gas experimentation.
- Test the physical andchemical properties of selected gases
- The operation of a chemical balance scale.
- Calculation of equivalent weights.
- Determine the equivalent weight of metal by hydrogen displacement method.
- Process of titration.
- Perform acid base titration.
- Preparation of solutions of various strengths.
- Calculation of strengths of unknown solutions in termsof normality, molality, molarity, grams/liter, and percentage.
- Detection of nitrogen, sulphur, halogens
- The identification of acetate, formate, formaldehyde,oxalate, oxalic acid, glycerol, acetone, ethyl alcohol, acetic acid, formicacid.
- Perform chemical tests.

Zoology (Theory)

Total: 5 hours /week
Lecture: 3 hours/week
Tutorial: 0 hour/week
Practical: 0 hours/week
Lab: 2 hours/week

Course Description
This basic course in zoology discusses the characteristics of unicellular and multicellular structures. The course contains introductory zoology, economic zoology, life process of mammals, evolution of organisms, and application of zoology, human health and a brief introduction about snakes found in Nepal. To be more relevant to the students of health science, the course involves a detailed study of different kinds of tissues, the life history of relevant parasites, and a detailed study of the anatomy and physiology of mammals.

Practical zoology includes the study of microscopes, a general study of animal kingdoms (museum specimens), preparation of temporary slides, dissection of mammals to expose different systems and the life cycle of mosquitoes and houseflies. It also includes the measurement of blood pressure and its effects. Practical zoology also gives the knowledge about the identification of blood groups in human and its significances.

Course Objectives
At the end of the course, the student will be able to:

- Tell the meaning, scope and different branches of zoology.
- Explain the structure and functions of different kinds of tissues in a body.
- Explain different kinds of parasites and arthropods related to human welfare.
- Describe different systems of mammals.
- Describe how organisms of today have evolved from the ancestral ones.
- Describe the different applications of biotechnology in human health.
- Identify the causes, symptoms and control of some health disorders.
- Identify common poisonous and nonpoisonous snakes and their effects.
- Handle microscope properly.
- Identify different kinds of animals.
- Prepare temporary slide mount of the given specimen.
- Dissect the mammal to expose its different systems.
- Describe different stages in the life cycle of mosquitoes and houseflies.

Course Content

Unit 1: Introduction to Zoology **2hrs**

- Meaning of Zoology
- Scope of Zoology
- Different branches of Zoology related to medical science:On the basis of structure and function - morphology, anatomy, physiology, histology, cytology, microbiology, ethology.
- On the basis of specific unit or field - toxicology, genetics, embryology, evolution, mycology, microbiology, ecology, pathology, parasitology, paleontology, taxonomy.
- On the basis of specific group - entomology, helminthology, protozoology, bacteriology, virology, ichthyology, ornithology, hepetology.

Unit 2:Animal tissues and their types **12hrs**

- Epithelial tissue
  - Definition of tissue and its types.
  - Functions of epithelial tissues i.e. protection, secretion, excretion, absorption, exchange of materials/gases, sensory.
  - Structure, locations and functions of different types of epithelial tissues.
  - Types of epithelial tissue; Simple epithelium, compound epithelium and specialized epithelium (ciliated, germinal, sensory and glandular epithelium)
- Connective tissues
  - Defination of connective tissue and its types.
  - Structural and functional study of different types of connective tissues.
  - Structure, location and function of connective tissue proper (areloar, adipose, tendon and ligament)
  - Structure, location and function of (cartilage and bone)
  - Composition and functions of blood and lymph
- Muscular tissues
  - Definition of muscular tissue and its types.
  - Structure and function of different types of muscular tissues.
  - Location of different types of muscular tissues in different regions of our body.
  - Differences between striated, smooth and cardiac muscles of animals.
- Nervous tissues
  - Definition of nervous tissue and its types.
  - Components of nervous tissue.
  - Structural and functional study of neuron.
  - Types of neurons and their location.
  - Difference between neuron and neuroglia.

Unit 3: Diversity of Animal Life **3hrs**

- Definition of taxonomy, species as a basic unit of classification, systematics, taxon, lower and higher taxa.
- Binomial system of nomenclature adopted by Carolus Linnaeus
- Selected examples of binomial nomenclature of animals.
- Five kingdom system of classification.
- Chief characteristics and examples of five kingdoms.
- Modern trends in taxonomy.

Unit 4: Economic Zoology **33hrs**

Sub-unit4.1: Hosts and parasites

- Meaning of hosts and parasites
- Common types of hosts and parasites with examples.
- Types of relationships between a host and a parasite.
- Delicate adjustments between hosts and parasites.

Sub-unit4.2:Medically important protozoans

- Systematic position, distribution, habitat, morphology, life cycle, mode of transmission, pathogenic effects and Preventive measures of: *Entamoeba histolytica, Plasmodium vivax*, and Leishmania *donovani*
- Miscellaneous Protozoa:
    - Systematic position, distribution, habitat, morphology, mode of transmission, pathogenecity and preventive measures of: *Entamoeba gingivalis, Giardia lamblia, Trichomonas vaginalis*

Sub-unit4.3:Medically important helminthes

- Distribution, habitat, morphology, life cycle, mode of transmission, pathogenic effects and Preventive measures of: *Taenia solium*, , *Ascaris lumbricoides*, *Schistosoma haematobium, Wuchereria bancrofti*.
- Miscellaneous Helminthes
    - Distribution, habitat, morphology, mode of transmission, pathogenecity and preventive measures of : *Taenia saginata, Fasciolopsis buski*, *Enterobius vermicularis*, *Dracunculus medinensis*..

Sub-unit4.4:Medically important arthropods

- Introduction, Classification and public health importance of medically important arthropods.
- Distribution, habit and habitat, morphology, diseases and control measures of :Mangemite (*Sarcoptes scabiei*)**,**Cockroaches (*Periplaneta americana*)**,** Houseflies (*Musca nebulo*)**,** Mosquitoes (*Culex*, *Anopheles* and *Aedes*)**.**
- General concept of Integrated vector management (IVM) approaches.

Unit 5: Life Process of Mammals **35hrs**

Sub-unit5.1: Digestive system

- Structure and functions of parts of alimentary canal of human (Mouth, buccal cavity, pharynx, esophagus, stomach, small intestine and large intestine).
- Structure and functions associated digestive glands (salivary gland, liver, pancreas, gastric gland and intestinal gland).
- Enzymatic actions of digestive glands for the digestion of carbohydrates, proteins and lipids.
- Absorption sites and processes of absorption of digested food

.Sub-unit52: Respiratory system

- Definition and types of respiration in animals.
- Structure and functions of the respiratory organs of human.
- Mechanisms of breathing
- Exchange of gases in lungs and tissue.

- Transport of oxygen and carbondioxide.
- Internal respiration, Bohr effect and Chloride shift.

.Sub-unit53: Circulatory system

- Definition and types of circulation.
- Structure (external and internal) of the heart of mammals.
- Course of blood circulation in heart.
- Double circulation (systemic and pulmonary circulation).
- Origin, conduction and regulation of heart beat.
- Concept of artificial pacemaker, Blood pressure and cardiac cycle.
- General concept of blood grouping and its significances in human beings

.Sub-unit54: Excretory system

- Meaning of excretion, types of excretory organs and their functions.
- External as well as internal structure of a kidney.
- Structure and functions of different regions of a nephron.
- Mechanism of urine formation (glomerular filtration, selective reabsorption, tubular secretion)
- Micturition and homeostasis.

.Sub-unit55: Reproductive system

- Definition of reproduction and its types - sexual and asexual.
- Structure and functions of male reproductive organs.
- Structure and functions of female reproductive organs.
- Menstruation cycle in female.

Sub-unit5.6:Nervous system

- Definition of nervous system.
- Types of nervous system (central, peripheral and autonomous).
- Structure and functions of different parts of brain.
- Transmission of nerve impulses.

Unit 6: Evolution 7hrs

- Brief description about the origin of life.
- Definition and Pattern of organic evolution
- Morphological and anatomical, palaeontological, and biochemical evidences.
- Description of : Lamarckism, Darwinism and Neo-Darwinism (modern synthetic theory of evolution) With examples.
- Summarize the evolution of modern man starting from human ancestors *Dryopithecus*.

Unit 7: Wildlife conservation 5hrs

- Definition of wildlife and conservation.
- Important of wildlife conservation.
- Describe different categories of wildlife with examples.
- Causes of extinction of wildlife.
- Brief discussion on protected areas of Nepal.

Unit 8: Application of biology **5hrs**

- Definition, types and application of antibiotics, immunity and v**accine** in human health.
- Definition and meaning of organ transplantation.
- Application of organ transplantation, examples of tissue and organ transplantation.
- Definition, brief process, advantage and disadvantage of amniocentesis.
- Definition and brief process of formation of test-tube baby.

Unit 9: Poisonous and nonpoisonous snakes **3hrs**

- Generall characteristics of snakes.
- Characteristics of poisonous snakes in Nepal.
- Distinguish between poisonous and non-poisonous snakes.
- Common poisonous snakes found in Nepal and their geographical distribution.
- Identification between a poisonous snakebite and a non-poisonous snakebite.
- Nature and types of snakes venum according to their effects in our body.
- First-aid treatment of snake bite.

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- Gupta and Malik, Practical Zoology (Chordate)

Final written exam marking scheme

unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
Unit hours	2	12	3	33	35	7	5	5	3	105
Marks	2	9	2	25	27	5	4	4	2	80

Zoology (practical)

Practical 70 hours

- Demonstrate the different parts of simple and Compound Microscope
- Observe the general characteristics of following museum specimens:
    - Protozoa:
        - Rhizopoda : - *Amoeba, Entamoeba histolytica*
        - Mastigophora : - *Euglena, Giardia, Leishmania*
        - Ciliata : - *Paramecium, Balantidium*
    - Porifera: *Sycon*
    - Coelenterata: *Hydra*
    - Platyhelminthes:
    - Cestodes : - *Taenia saginata, Taenia solium, Echinococcus granulosus*
    - Trematoda: - *Fasciola hepatica*
    - Nemathelminthes: *Ascaris lumbricoides, Enterobious vermicularis, Ancyclostoma duodenale,*
    - Annelida: *Pheretima* (Earthworm), *Hirudinaria* (Cattle Leech).
    - Arthropoda:
        - Crustacea: - Prawn, Crab.
        - Arachnida: - Scorpion, Spider
        - Myriapoda: - Millipede, Centipede
        - Insecta: - *Anopheles* and *Culex*, *Pediculus, Cimex*.
    - Mollusca:*Unio, Limax* and *Pila*
    - Echinodermata: Starfish
    - Chordata:
        - Pisces: - *Scoliodon,Labeo rohita*
        - Amphibia: - Frog and Toad
        - Reptilit:- Wall Lizard,Tortoise, *Viper*,*Bungarus* and *Natrix*
        - Aves:- Crow and Pigeon
        - Mammalia:- Bat, Rabbit
- Prepare the temporary slides of following material and observe under microscope:
    - Striated muscle, larvae of mosquito, mouth parts of mosquito
- Demonstrate animal tissue through permanent slides.
    - Epithelial tissue: Squamous, Cuboidal and Columnar.
    - Connective tissue: Areolar, Adipose, Blood
    - Muscular tissue: Striated, Smooth and Cardiac
    - Nervous tissue**:** Neuron
- Perform the dissection of mammals
    - digestive, arterial, venous, reproductive, brain through direct observation of the preserved body.
- Demonstrate the Life cycle of *Anopheles* and *Culex* mosquitoes and houseflies**.**
- Demonstration of chart of different organ systems of human (Alimentary canal, Respiratory organs, Kidney, Heart and mammalian brain).
- Demonstration the chart of lifecycle of *Plasmodium, Ascaris,* and *Taenia*.
- Field visit and Report writing (compulsory).

Botany (Theory)

Total: 5 hours /week
Lecture: 3 hours/week
Tutorial: 0 hour/week
Practical: 0 hours/week
Lab: 2 hours/week

Course Description

This course provides basic knowledge about botany, divided into eight units. The first unit gives general information about botany including different life components. The second unit talks about the structure and functions of a cell and its organelles including the cell reproduction. The third unit discusses the diversity of life, and includes basic information about algal plants, fungal plants, bacteria, and viruses. Unit four provides information about life processes of plants such as diffusion, osmosis, photosynthesis, respiration and transpiration. Unit five teaches about heredity and variation. This unit also provides information about genetic diseases/disorders in humans. Unit six provides information about the factors of our environment, their interrelationships, and effects of pollutants on human health. Unit seven includes information about selected medicinally and nutritionally important plants. Unit eight provides information about biotechnology and genetic engineering.

Course Objectives

At the end of the course, the student will be able to:
Explain the scope of botany and its different branches.

- Explain the life components, cell structures and their functions.
- Explain the different physiological processes in a plant body.
- Explain the role of genes and their transmission to the progeny.
- Describe how environmental factors and pollutants affect our lives.
- Identify different members of plant kingdom based on their general characteristics.
- Describe the life cycle of selected plant species from algae and fungi.
- Identify the economic importance of viruses, bacteria, algae, and fungi in the field of medicine.
- Describe the application of biotechnology in the field of medical science.

Contents

UNIT 1: Introduction **4 Hrs**

- Definition of biology and botany.
- Objectives and scope of botany.
- Difference between living organisms and non-living things.
- Importance of plants.
- Different branches of botany.
- Correlation between botany and other branches of sciences.

Unit 2. Life components **7hrs**

- Introduction
  - Define cellular pool, biomolecules, macro, and micro molecules.
  - Types of biomolecules i.e. inorganic and organic biomolecules
  - Inorganic biomolecules: definition
  - List of inorganic biomolecules, their roles and the condition caused due to their deficiency
  - Organic biomolecules: definition
  - List some important organic biomolecules namely,
    - Carbohydrate: Definition, Types, and Importance
    - Lipids: Definition, Types, and Importance
    - Amino acids and proteins: Definition, Types, and Importance
    - Enzymes: Definition, Types, and Importance
    - Nucleic acid: Definition, composition, Types, Double helical structure of DNA, types of RNA and Importance

Unit 3: Cell biology **19hrs**

- Introduction of Cell Biology
- Introduction Of Cell Theory
- Component of Cell
- Cell wall
  - Definition
  - Layers in cell wall i.e. middle lamella, primary cell wall and secondary cell wall
  - Structures in cell wall i.e. plasmodesma and pit
  - Importances of cell wall
- Cell membrane
  - Definition
  - Listing components of cell membrane
  - Structure of phospholipids
  - Fluid mosaic model of cell membrane
  - Basic introduction to transport across membrane
  - Importances of cell membrane
- Cytoplasm
  - Definition and its composition
  - Regions in cell membrane
  - Importances of cytoplasm
  - Introduction of cell organelles and cell inclusions
- Mitochondria
  - Introduction
  - Components
  - Importances
- Plastids
  - Introduction
  - Types: leucoplast, chromoplast and chloroplast
  - Basic introduction of leucoplast and chromoplast

- Chloroplast
  - Introduction
  - Components
  - importance
- Endoplasmic reticulum (ER)
  - Introduction
  - Components
  - Types: SER and RER and their differences
  - Importance
- Golgi bodies
  - Introduction
  - Components
  - Importances
- Ribosomes
  - Introduction
  - Types and their subunits
  - Importances
- Vacuoles
  - Introduction
  - Types on the basis of contents
  - Importances
- Nucleus
  - Introduction
  - Components and their function
- Chromosomes
  - Introduction
  - Components
  - Types of chromosomes on the basis of position of centromere
  - Basic introduction of chromatid
- Cell division
  - Introduction and its significance
  - Introduction to cell cycle and its phases:
    - Interphase
    - M-phase
  - Introduction of interphase, its sub-phases with the changes that occur during them
  - Introduction of M-phase and its sub-phases: Karyokinesis and cytokinesis
  - Types of cell division:
    - Amitosis
    - Mitosis
    - Meiosis
      - Introduction of amitosis, its examples with its disadvantages
      - Introduction of mitosis, its phases and its importances
      - Introduction of meiosis, meiosis I and meiosis II, their phases and its importances
      - Differences between mitosis and meiosis

Unit 4. Diversity of life **25hrs**

- Biodiversity
  - Introduction, categories, importances and scopes of biodiversity
  - Concept of taxonomy and nomenclature: binomial nomenclature with its advantages
  - Classification and its types: artificial, natural and phylogenetic
  - Taxonomic hierarchy
  - Classification of organisms,
    - Five kingdom system, its criteria, characteristics of those kingdom, its advantages, and disadvantages
- General characteristics of different plant groups
  - Introduction and listing the characteristics of plant groups:
    - Algae
    - Bryophytes
    - Pteridophytes
    - Gymnosperms
    - Angiosperms (also the differences between dicot and monocot plants)
- Algae
  - Introduction and its classification with their characteristics.
  - Spirogyra, its habitat, structure, mode of reproduction: vegetative, asexual and sexual methods, germination of zygospore
  - Economic importances of algae
- Fungi
  - Introduction and its classification with their characteristics.
  - Mucor, its habitat, structure, mode of reproduction: vegetative, asexual and sexual methods, germination of zygospore
  - Aspergillus, its habitat, structure, mode of reproduction: vegetative, asexual and sexual methods
  - Penicillium, its habitat, structure, mode of reproduction: vegetative, asexual and sexual methods
  - Mushroom, its habitat, basic structure, some basic differences between poisonous and non-poisonous mushrooms
  - Economic importances of fungi
- Bacteria
  - Introduction, characteristics with a typical structure of bacteria
  - Classifications based on shape, flagella and nutrition
  - Gram staining
  - Koch's postulates
  - Bacterial growth curve
  - Economic importances of bacteria
- Cyanobacteria
  - Introduction, characteristics and cell structure
- Virus
  - Introduction with characteristics i.e. both living and non-living
  - Types of viruses based on host and genetic material
  - Typical structure of bacteriophage

- Lifecycle of bacteriophage: lytic and lysogenic
- Effect of retrovirus
- Some typical symptoms of viral disease in plants
- Economic importances

- Lichens
  - Introduction, occurrence, types and economic importances

Unit 5. Physiology **16hrs**

- Introduction
  - Concept of physiology with five major processes:
    - Diffusion
    - Osmosis
    - Transpiration
    - Photosynthesis
    - Respiration
- Diffusion
  - Concepts of diffusion, rate of diffusion and diffusion pressure
  - Experiment to demonstrate diffusion
  - Factors affecting diffusion
  - Importance with examples related to medical field
- Osmosis
  - Concept of osmosis in relation to solvent and solute
  - Some terms: water potential, solute potential, osmotic pressure, DPD, plasmolysis and deplasmolysis
  - Experiment to demonstrate osmosis by potato Osmoscope and egg membrane method
  - Factors affecting osmosis
  - Importance with examples related to medical field
- Transpiration
  - Concept of transpiration and its types
  - Experiment to demonstrate transpiration by bell jar method
  - Basic structure of stomata in dicot and monocot
  - Experiment to demonstrate unequal transpiration in dorsiventral leaf
  - Factors affecting transpiration
  - Guttation and its differences with transpiration
  - Importances and disadvantages of transpiration
- Photosynthesis
  - Concept of photosynthesis and its stages: light dependent and light independent reactions (in brief)
  - Photosynthetic pigments (brief without structure)
  - Experiment to demonstrate CO_2 is necessary for photosynthesis (Moll's half leaf experiment)
  - Experiment to demonstrate chlorophyll is necessary for photosynthesis
  - Experiment to demonstrate O_2 evolved during photosynthesis
  - Factors affecting photosynthesis

- Photorespiration: definition, advantages and disadvantages
- Translocation of photosynthates
- Importances

- Respiration
  - Concept of respiration, its types and their differences
  - Experiment to demonstrate that CO_2 evolved during aerobic respiration
  - Experiment to demonstrate that CO_2 evolved during anaerobic respiration
  - Factors affecting respiration
  - Importance's

Unit 6. Genetics **11hrs**

- Introduction
  - Concept of genetics with heredity and variation, and types of variation i.e. acquired and germinal (continuous and discontinuous)
  - Concepts of clone and offspring
  - Importance's of variations
  - Some terms in genetics
- Mendel's laws
  - Statement of law of dominance, law of segregation and law of independent assortment with suitable cross, observation and conclusion
- Genetic codon
  - Introduction with properties of genetic codon
- Mutation
  - Concept of mutation, muton and mutagens
  - Types of mutation: spontaneous and induced
  - Types of mutation:
    - Gene mutation: Introduction with types i.e. substitution, frameshift and non-sense mutation
    - Chromosomal mutation: Introduction with types: chromosomal aberration and ploidy
      - Chromosomal aberration: Introduction and its types: intrachromosomal (introduction with types: deficiency and deletion, duplication and inversion) and interchromosomal (introduction with translocation and its types)
      - Ploidy: Introduction with types: aneuploidy (introduction with types) and euploidy (introduction with types) [No need of examples of polyploidy]
- Genetic disorder
  - Introduction and its types
    - Down's syndrome
    - Edward's syndrome
    - Turner's syndrome
    - Klinefelter's syndrome
    - Autism
    - Albinism
    - Alzheimer's disease

- Haemophilia (with inheritance pattern)

Unit 7. Environmental biology **10hrs**

- Ecology
  - Concept of ecology with some commonly used terms like ecosystem, biotic and abiotic factors, population, community, autecology and synecology.
  - Structural components of ecosystem and their concepts
    - Abiotic factors: climatic, edaphic and topographic factors
    - Biotic factors: autotrophs and heterotrophs with their types
  - Functional components of ecosystem and their concepts
    - Food chain and its types
    - Food web
    - Ecological pyramid and its types
  - Pond ecosystem: Introduction with structural and functional aspects
  - Forest ecosystem: Introduction with structural and functional aspects
- Pollution of air and water
  - Introduction of pollution, pollutants and its types and sources of pollution and its types
  - Air pollution: Introduction, causes, consequences with examples of disease, and preventive and control measures
  - Water pollution: Introduction, causes, consequences with examples of disease, and preventive and control measures
- Environmental hazards
  - Introduction of environmental hazards
  - Greenhouse effect: Introduction along with greenhouse gases and global warming, causes, consequences, preventive and control measures, and recent development
  - Ozone layer depletion: Introduction along with ozone and ozone layer, causes, consequences, preventive and control measures, and recent development
  - Acid rain: Introduction, causes, consequences, preventive and control measures, and recent development
  - Biological invasion with examples, its effects, and preventive and control measures.

Unit 8. Economic Botany **5hrs**

- 7.1. Medicinally important plants
  - Introduction with scientific name and uses of following plants
    - Mint
    - Malabar nut
    - Ginger
    - Snake roots
    - Cinnamon
    - Poppy
    - White sandalwood
    - Cardamom
    - China berry
    - Holy basil

        - Indian aloe
        - Margosa tree
        - Cordycep
        - Marsh orchid
        - Thorn apple
- General concept of ethnobotany
    - Introduction, importance and approaches (also provide some examples of plants used as medicine in local areas)

Unit 9. Biotechnology **8hrs**

- Introduction
    - Concept, branches, areas and applications of biotechnology
- Plant tissue culture
    - Concept, types and applications
- Bio fertilizer
    - Concept and some major types of biofertilizers with examples
- Genetic engineering
    - Concept with an example of insulin, applications and possible dangers of genetic engineering
    - Basic concepts of DNA fingerprinting and DNA profiling
- Fermentation technology
    - Concept, types of fermentation and applications of fermentation technology

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Final written exam marking scheme

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
Unit Hours	**4**	**7**	**19**	**25**	**16**	**11**	**10**	**5**	**8**	105
Marks	**3**	**5**	**15**	**19**	**12**	**8**	**8**	**4**	**6**	80

Botany (Practical)

Practical 70 hours

Unit 1: Introduction to the compound microscope

- Differentiate between simple and compound microscope.
- List different parts of a compound microscope and their uses.
- Calculate the magnifying power of a compound microscope in different combinations of objective lens/eye-piece lens.
- Demonstration of handling a compound microscope.
- Draw a well labeled diagram of a compound microscope by observation.
- List the apparatus required to prepare temporary slides of plant cells.
- List the chemicals required to prepare temporary slides of plant cells.
- List the function of safranine and glycerine.
- Demonstration of method of slide preparation from the epidermal layer of onion scale, Tradescantia leaf, Hydrilla leaf, Geranium leaf.
- Compare the cell structure of Onion scale, Tradescantia leaf, Hydrilla leaf, and Geranium leaf.
- List the characteristics of the cellular structure of each.
- Demonstration of method to peel out the epidermal layer in each case.
- Use glycerin instead of water when mounting a temporary slide.'
- Draw diagrams of each by observing temporary slides under the microscope

.2: Different stages of mitosis and meiosis divisions from permanent slides.

- Demonstration of nuclear changes in each stage of mitosis using charts.
- Give examples of mitotic cell division in plants.
- Demonstration of nuclear changes in each stage of meiosis using charts.
- Give examples of cells where meiotic cell division occurs.
- Draw figures of mitosis and meiosis by observing under the microscope

Unit 3: Biodiversity

3.1: Monera

- Perform the experiment of Gram staining.
- Differentiate Gram positive bacteria from Gram negative bacteria.
- Draw diagrams of bacteria by observing under the microscope.
- Observe the vegetative structure of *Nostoc*.
- Draw figures of these as observed under the microscope.

3.2: Vegetative structure and reproductive stages of Spirogyra

- Observe the vegetative structures of Spirogyra.
- Observe the reproductive stages of Spirogyra.
- Draw figures of these as observed under the microscope.
- Mention the systematic position of Spirogyra.

3.3: Vegetative structure and reproduction of selected fungi

- Observe the vegetative structure and reproductive stages of:
- Mucor
- Aspergillus
- Penicillium
- Differentiate between poisonous mushrooms and edible mushrooms.
- Draw figures of both poisonous and nonpoisonous mushrooms.

3.4: Bryophytes, Pteridophytes, Gymnosperms and Angiosperms

- List the morphological features of bryophytes and pteridophytes and differentiate between them.
- List the morphological features of gymnosperms and angiosperms and differentiate between them.
- Differentiate dicot plants from monocot plants.
- Observe the parts of at least two flowers:
  - Calyx
  - Corolla
  - Androecium
  - Gynoecium
- Draw figures of each of the plants which are observed during the lab experience.

Unit 4: Plant physiology

4.1: Demonstration of physiological experiments (diffusion, osmosis, transpiration, photosynthesis and respiration)

- Demonstrate the procedure of each physiologic experiment, observation, result and conclusion with precautions.
- Draw the necessary figures to show the demonstration of each experiment.

Unit 5: Ecology

5.1: Ecosystem and Adaptation features of selected plants

- Observation of aquatic ecosystem during field visit.

Unit 6: Genetics

6.1: Structure of DNA

- Draw a figure of the Watson and Crick model of DNA by observation of a model

6.2: Demonstration of some common genetic disorders using charts

- Down's Syndrome
- Edward's Syndrome
- Albinism
- Haemophilia
- Autism

Mathematics & Statistics (Theory)

Total: 6 hours /week
Lecture: 4 hours/week
Tutorial: 1 hour/week
Practical: 0 hours/week
Lab: 1 hours/week

Course Description
The course is divided into three parts: (a) Elementary Mathematics, (b) Elementary Statistics and (c) Practical on elementary Statistics and Computer. Part one of this course prepares the student to use mathematical skills necessary for application of medical computations, application of research and statistical interpretations, and for managing the mathematical questions of everyday life. Part two provides a basic overview of the purpose and process of research, a discussion of scientific process, and principles of research methodology in statistics. Part three enables the students to apply statistical methods to the interpretation of data related to public health services using basic computer skills.

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

- Apply mathematical Skills to solve medical problems and interpret research data.
- Use vital statistic terminology to discuss public health issues.
- Explain the function and value of research.
- Describe the process and methodology of research.
- Apply mathematical formulas to interpret research data.
- Demonstrate the process of report writing.

Course Content

Part 1 Elementary Mathematics **66 hrs**

Unit 1: Set theory and real number system **6 hrs**

- Define and denote sets.
- Find subsets of a set and represent the sets in Venn diagrams.
- Find the union, intersection, complement and difference of given sets.
- Define cardinality of a finite set
- Define real numbers, absolute value, open and closed intervals and inequalities.
- Proof of the Algebra of sets, De-Morgan's law

Unit 2: Function and graph **6 hrs**

- Define ordered pair, Cartesian products and relation,
- Define Domain and range of relation.
- Define a function
- Classify functions.
- Identify the different functions.
- Define domain and range of relation (excluding inverse and composite function)
- Functions and their inverse and related problems.

- Composite function and related problems (Algebraic only)
- Exponential and Logarithmic functions

Unit 3: Permutation, combination and binomial theorem. 9hrs

- Concept of Basic principles of counting.
- Define the permutation and combination
- Use different cases of permutation and combination (simple cases only).
- Define binomial expression and Binomial theorem.
- Binomial theorem (without proof)
- Finding general term, middle term/s, binomial coefficients.

Unit 4: Matrices and determinants 9 hrs

- Matrix, its notation and order.
- Types of matrices and simple algebra of matrices.
- Addition, subtraction, multiplication of matrices.
- Transpose, Adjoint and inverse of a matrix and related problems.
- Definition of a determinant.
- Minors and cofactors
- Properties of determinants.
- Application of matrix and determinant to solve linear system of equation (inverse of matrix and Cramer's Rule)

Unit 5: Algebra& Straight Line 2 hrs

- Recall the formula of distance between two points and its slope.
- Find the angle between two lines and derive the condition of perpendicularity and parallelism.
- Distance between two parallel lines.
- Area of triangle.
- Section formula

Unit 6: Co-ordinate Geometry (Equation of a pair of lines) 6hrs

- Define line pair equation, express two equations of straight lines as a single equation
- Condition required for general equation representing a pair of lines. (**Without prove)**
- Separate equations from general equation of second degree.
- Prove that the equation $ax^2 + 2hxy + by^2 = 0$ always represents a pair of straight lines passing through the origin.
- Find the angle represented by $ax^2 + 2hxy + by^2 = 0$. (Without prove)
- Find the angle of bisectors represented by $ax^2 + 2hxy + by^2 = 0$. (**Without prove)**

Unit 7: Limits and limiting values 6 hrs

- Indeterminate forms $\left(\frac{0}{0}, \frac{\infty}{\infty}\ and \infty - \infty\right)$
- Define the term *limit* and *limiting* value.
- Evaluate the limiting values of simple algebraic & trigonometric function.

- Using $\lim_{x \to a} \frac{x^n - a^n}{x-a}$ and $\lim_{x \to 0} \frac{sinx}{x}$.(Without prove)

- Define continuity and discontinuity
- Identify continuous and discontinuous function.

Unit 8: Derivatives and their Applications (Maxima and Minima) 6 hrs

- Definition of the term derivatives.
- Geometrical meaning of derivatives.
- Find the derivative $(ax + b)^n$, $\sin(ax + b)$, e^{ax+b}, $\log(ax + b)$ from definition (first principle)
- Sum, difference, product, quotient and chain rule (derivate of algebraic function only)
- Application of derivative: - increasing, decreasing and stationary points.
- Maximum, minimum values of a given algebraic function and point of inflection.
- Concave upward and concave downward **(algebraic only**)

Unit 9: Integration 10 hrs

- Definition of integral as anti-derivative,
- Application of techniques of integration as anti-derivative, substitution method, integration by parts and definite integral **(algebric only).**
- Using definite integral to calculate area enclosed by algebric curve, X-axis and ordinate at x = a to x = b

Unit 10: Probability 6 hrs

- Definition of probability (classical and empirical)
- Application and use of addition and multiplication law of probability
- Explanation and use of binomial probability distribution formula $P(r) = C(n,r)p^r q^{n-r}$

Part B: **Elementary Statistics 46 hrs**

Unit 11: Introduction to Statistics 3 hrs

- Define statistics
- State the utility, functions and limitations of statistics.

Unit 12: Collection, Classification and Tabulation diagrams and graphs (Revision only) 3 hrs

- 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

Unit 13: Central tendency 5 hrs

- Definition of central tendency

- Mean, median, mode Quartiles, Deciles and Percentiles.(for ungrouped and grouped data mathematically)

Unit 14: Measure of dispersion **8 hrs**

- Range and coefficient of range
- Quartile deviation and coefficient of Q.D.
- Mean deviation from mean, median and mode.
- Standard deviation and C.V.

Unit 15: Correlation Coefficient **9 hrs**

- Concept of correlation and its type.
- Method of studying correlation by drawing Scatter diagram
- Calculations of Karl Pearson's coefficient of correlation between two variables.
- Sparman's rank correlation.

Unit 16: Vital statistics **10 hrs**

- Vital Statistics
  - Definition of the term vital statistics.
  - Utility of vital statistics.
  - Different sources of vital statistics.
- Measure of Fertility
  - Meaning of Fertility
  - Different measures of fertility
  - Different indicators related to fertility (crude birth rate, specific fertility rate, General Fertility rate, total fertility rate)
- Measures of mortality
  - Meaning of mortality
  - Different measures of mortality
  - Different indicators related to mortality (crude death rate, specific death rate, infant mortality rate, maternal mortality rate and still birth rate)
- Measures of morbidity (sickness)
  - Meaning of morbidity
  - Different measures of morbidity
  - The incidence rate and prevalence rate

Unit 17: Research methodology **4 hrs**

- Definition of research
- Research methodology.
- Steps of research.
- Discuss the importance of interpreting research results Scientific method.
- Statistical tools for measuring reliability of results.
- Interpreting and understanding research data.
- Applications of research in medical science.

Unit 18: Introduction to Report Writing **4 hrs.**

- Explain the concept of report writing.
- Familiarize with standard research report format.
- Purposes and goals of research reports.
- Significance of research reporting

Part C: **Basic Computer Skills** **28 hrs**

Unit 19: Introduction of computer

- Basic introduction of computers (Features, application/scope/uses)
- Importance of computers in medical field.
- Introduction to computer ergonomics, Health problems caused by computer and how to take precautions.

Computer systems

- Components of computer system
- Basic hardware components of computer system
    - Input devices
        - Keyboard, Mouse, Joystick, Trackball, Light pen, Touch pad, Touch Screen, Digital Camera, Scanner, OCR, OMR, Digitizing Tablet
    - Processing hardware
    - Storage devices
    - Output devices
        - Monitor (CRT, LCD, LED)
        - Printer (Impact: dot matrix printer) Non-impact: (Laser printer, Ink-jet printer, Thermal printer)
        - Multimedia projector
        - Speakers
- Computer software: systems, applications, and utility software.
- Memory Unit
    - Primary Memory (Cache Memory, RAM ,ROM
    - Secondary Memory (Magnetic Storage, Optical Storage, Flash Memory
- Parallel port, serial port, PS/2 port, USB port, DVI port, sockets, VGA port, interfacing (IDE, SATA, PATA)

Concept of internet and office automation package

- Introduction to browsers like Firefox, Internet Explorer, Safari
- Uses of Internet (Internet Telephony, E-commerce, e-Government, e-Education, e-Health and Videoconferencing)
- Search Engine
- Email Services (Email Account & Its Functions)

- Introduction to Office automation package(MS Word, Excel, Powerpoint) and its importance

Computer and Statistics (practical) 35 hrs

The paper on elementary statistics is designed to supplement theoretical knowledge. In this subject the students themselves will solve different problems with different types of data and Information, which helps them to learn the subject quickly and enjoy the real, need of learning it and apply their knowledge in real life situations, for an effective health care delivery and administration.

Students will be required to maintain a notebook to keep the records of fully practical work duly Signed by the instructor which should contain a minimum of practical and this should be submitted on the date of examination.

All the portion of Computer skill should be done in a practical room having individual computer to practice. Here first 1 hour should be devoted for theory description and procedure and second 1 hour should be for practice in the computer. It is better to have statistics practical done in computer as far as practicable.

- **Statistics:**
  - Prepare individual (discrete) and grouped frequency distribution table.
  - Prepare histogram, frequency polygon and curve, and cumulative frequency curve.
  - Draw bar diagram, subdivided, percentage and multiple bar diagram
  - Draw pie diagram.
  - Find mean for individual and grouped series.
  - Find meaning by shortcut or graphical method.
- **Computer:**
  - Introduction to hardware peripherals and how to remove or connect them in computer.
  - Desktop Settings & Control Panel
  - Manage proper folder structure to store files in order
  - Searching files
  - Installing and Uninstalling applications
  - Manage backups of files to avoid from loss of data
  - Setting printing preferences before printing
  - Open printer cartridge to remove paper jams, replace printer cartridge
  - Virus and security threats, using antivirus to avoid virus threats

Word Processing (MS Word)

- Create Save, save as, open, close document
- Creating styles and formatting documents
- Managing page numbers, header and footer
- Create and customize the table

- Proofing and layout a document

- Creating a Table of Contents, List of tables, and list of figures
- Inserting Chart
- Creating chart and flowcharts using basic shapes.
- Creating PDF files/Converting word files to PDF
- Manage printing documents

MS. Power Point:

- Create and save presentations
- Apply layout and templates
- Design slides.
- Animation on slide
- Inserting hyperlink, slide number, date and time
- Apply slide transition effect
- Printing presentation in handout formats

MS. Excel:

- Practices on save, open worksheet and workbook
- Demonstrate shell address
- Formatting worksheets.
- Sorting and filtering data
- create a frequency table and apply formula to calculate mean value
- Creating, formatting graphs
- Print excel data sheet and page setup

(Note: The statistical tools should be introduced from an applied perspective using health Related examples.Microsoft excel software will be used throughout the course to aid in statistical analysis)

Email/Internet

- Knowledge of bookmarking, history, tabs
- Creating email account, Sending emails with attachments

Recommended Texts

- Bajracharya, D.R. & et al., Basic Mathematics, for grade XI and XII National Book Centre, Kathmandu.
- Mahajan B.K.Method of Biostaticstics, (16th edition) park's text book of PSM 2003
- Advance Mathematic & Statistics, Surya Publication., Kathmandu
- Pradhan, J. B. & Pantha, B. R. Integrated Mathematics for Health Science. Sukunda Pustak Bhavan,Bhotahity, Kathmandu.
- MS-DOS Manual, Microsoft.
- MS-Windows Manual, Microsoft.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	**Total**
Unit Hours	6	6	9	9	2	6	6	6	10	6	3	3	5	8	9	10	4	4	28	**140**
Marks	3	3	5	5	1	3	3	3	6	3	2	2	3	5	5	6	3	3	16	**80**