Curriculum

Certificate/Diploma Level

in

Health Sciences

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

(First year)

Council for Technical Education and Vocational Training

Curriculum Development Division

Sanothimi, Bhaktapur

Revision on July 2016

Table of Contents

1. Program Description

This first year curriculum is designed for all health science programme of Diploma/Certificate level (General Medicine, Medical Laboratory Technology, Radiography, Homeopathy, Ayurveda, Amchi Science, Dental Science, Opthalmic Science, Pharmacy and Ocupuncture, ocupressure & Moxisbuston) except PCL Nursing. In this curriculum foundational subjects such as Mathematics, English, Nepali, Social Study and Basic Sciences (Chemistry, Physics, Botany & Zoology) are offered to built the base. The disciplinary subject 'Anatomy and physiology' is included in order to lure them to their respective field. Most of the subjects offered in first year are of theoretical nature with some lab practices in basic science, computer and anatomy & physiology. It has the computer part in mathematics that demands practice in computer lab. Anatomy and physiology introduces the sector and guides the students to their specified medical field. The curriculum structure and the content reflects the details of all first year subjects. Academic requirements to enter bachelor in health sciences is considered while designed this first year course.

2. Target Location:

The target location will be all over Nepal.

3. Entry criteria

- SLC Pass upto 2071 SLC or SLC with GPA 2.00 plus minimum C grade in Compulsory Mathematics, English & Science after letter grading.
- TSLC in relevant decipline with minimum 66.68%.
- Should pass entrance examination as administered by CTEVT.

4. Selection:

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

5. Medium of Instruction:

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

6. Pattern of Attendance:

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

7. Teacher and Student Ratio

- Overall ratio of teacher and student must be 1:10 (at the institution level)
- For theory: As per the nature of the course
- For practical/lab/demonstration: 1:10

8. Program Coordinator, Teachers and Demonstrators:

- The foundational subject related teacher should be master degree holder in the related area.
- The disciplinary subject related teacher should be a bachelor's degree holder in the related area.
- The demonstrators should be bachelor's degree holder in the related area with two years experiences in training activities

9. Instructional Media and Materials:

The following instructional media and materials are suggested for the 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, overhead transparencies, slides etc.).
- ***Audio-Visual Materials*** (audiotapes, films, slide-tape programmes, videodiscs, videotapes etc.).
- ***Computer-Based Instructional Materials*** (computer-based training, interactive video etc.).

10. Teaching Learning Methodologies:

The methods of teachings for this curricular programme will be a combination of several approaches (not limited to as mentioned here) such as illustrated lecture, tutorial, group discussion, demonstration, simulation, guided practice, practical experiences, report writing, term paper presentation, project work and other independent learning.

Theory: Lecture, discussion, interaction, assignment, group work.
Practical: Demonstration, observation, guided practice, self-practice, project work, etc.

11. Mode of Education:

There will be inductive and deductive mode of education.

12. Examination and Marking Scheme:

- The subject teacher will internally assess the students' achievement in each subject during the course followed by a final examination at the end of the year.
- A weightage of internal assessment and annual examination are allocated in the course structer of this curriculum.
- The final examinations of all theory part will be administered through written tests.
- For theory exam, short and long questions will be asked covering all units of subjects as far as possible.
- The method of continuous assessment will be adopted for practical components. Final practicum evaluation will be based on:
    a. Institutional practicum attendance - 10%
    b. Logbook/Practicum book maintenance - 10%
    c. Spot performance (assigned task/practicum performance/identification/arrangement preparation/measurement) - 40%
    d. Viva voce : Internal examiner - 20%
    External examiner - 20%
- Student who fails in the internal assessment of any subject will not be allowed to sit in the final examination of that subject.

13. Provision of Back Paper:

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

14. 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.

15. Pass Marks:

The students must secure minimum of 40% marks in theory and 50% marks in practical. Moreover, the students must secure minimum pass marks in the internal assessment and final examination of each subject of theory and practical separately to pass all subjects offered

Course Structure

First year

SN	Subject	Activity	Mode			Distribution of Marks						Total Marks	Remarks
						Theory			Practical				
			T	P	Total	Internal	Final	Exam Hour	Internal	Final	Minimum Exam Hour		
1	English	T	3	0	3	20	80	3	-	-	-	100	
2	Nepali	T	3	0	3	20	80	3	-	-	-	100	
3	Social Studies	T	2	0	2	10	40	1.5	-	-	-	50	
4	Anatomy & Physiology	T+P	4	1	5	20	60	3	10	10	3	100	
5	Physics	T+P	4	2	6	20	60	3	10	10	3	100	
6	Chemistry	T+P	4	2	6	20	60	3	10	10	3	100	
7	Zoology	T+P	3	2	5	20	60	3	10	10	3	100	
8	Botany	T+P	3	2	5	20	60	3	10	10	3	100	
9	Mathematics & Statistics	T+P	4	1	5	20	60	3	10	10	3	100	
	Total		**30**	**10**	**40**	**170**	**560**		**60**	**60**		**850**	

English

Program	**Health Science**	**Total Hours:**	**1**
Year	**First**	**Weekly Hrs:**	**3**
Level	**Certificate**	**Theory:**	**1**
		Internal Assessment:	**2**
		Final Assessment:	**8**

Course Description

This is an integrated general English course, which treats English as a medium for communication a means to knowledge and skill related to health. It provides a remedial refresher course includin English grammar and structures and use of a dictionary, tools for receiving and imparting infor effectively, and exposure to poems, essays and stories which are interesting and informative topics of interest. This course provides a bridge between secondary and university English.

Course Objectives

On completion of the course student will be enabled to:

- Use English for academic and communicative purposes.
- Demonstrate functional, notional and grammatical skill in English language usage.
- UseEnglish structures in informal communication.
- Analyze the prescribed texts related to different literary genres.
- Answer the questions based on the reading texts.
- Produce different types of free compositions

Contents:

Part 1: Grammar

Unit 1: Link English	**Theory Time Hrs. 10**
Objectives:	Contents
• Use English dictionary appropriately • Differentiate American and British English spelling • Enrich English vocabulary • Form English sentences correctly	• Dictionary Skills: Alphabetic order, dictionary quarter system, guide words, head words etc. • British and American English: spelling differences • Word formation process through affixes (prefix and su vocabulary • Sentence formation
Unit 2: Comparison	**Theory Time Hrs. 5**
Objectives	Contents
• Apply the structures for making comparisons using adjectives and adverbs	• Comparatives and superlatives forms of Adjectives • Comparative and superlatives and there uses • Other ways of comparing things
Unit 3: Prepositions	**Theory Time Hrs. 5**
Objectives	Contents
• Apply the prepositions ‘in’, ‘on’ and ‘at’ in different contexts.	• Prepositions of Place: on, in, at • Prepositions of Time: on, in, at • Prepositions with forms of transport
Unit 4: Tenses	**Theory Time Hrs. 8**
Objectives	Contents
• Use present tenses, past tenses and perfect tenses in different situations. • Talk about the future using ‘will’ and ‘going to’	Auxiliary verbs: be, have, do • The Present Tenses • The past tenses • The perfect tense

• Talk about the future using present tense	• Talking about the present tense • Talking about the past • Reporting the past • Talking about the future using 'will' and 'going to' • Talking about the future using present tense
Unit 5: Mood	**Theory Time Hrs. 7**
Objectives	Contents
• Apply the structures for making yes/no questions beginning with auxiliary or modal. • Use Question tags • Use indirect questions to ask for information or help. • Use negative sentence with "not"	Questions • Wh – words • Question tags- forms • Question tags – uses • Indirect and reported questions • Negative sentence with "not"
Unit 6: Modals	**Theory Time Hrs. 7**
Objectives	Contents
• Introduce modals • Use modals for probability, certainty, permission, instructions, request and suggestions.	• Instructions to modals • Modal negative and questions • Can/ could, may/ might- possibility • Cannot, can't, must, ought, should, will- probability and certainty. • Can , could , may – permission • Can/could, will/ would – Instructions and requests • Can/could,might, shall - suggestions
Unit 7: The Passive	**Theory Time Hrs. 4**
Objectives	Contents
• Transform the active voice into passive. • Use 'it' and 'there' as impersonal subjects	• The passive voice • "It" as impersonal subject • 'There' as impersonal subject
Unit 8: Reporting	**Theory Time Hrs. 4**
Objectives	Contents
• Make reporting structures using 'that clause'. • Perform reporting and order, request and advise.	• Reporting structures- 'that clause' • Other report structures
Unit 9: Sentence Structures	**Theory Time Hrs. 10**
Objectives	Contents
• Use time clauses in various situations. • Make conditional clauses with 'if' and 'unless'. • • Use defining and non-defining relative clauses.	Time clauses • Conditional clauses using 'If' • Conditional clauses using modals and 'unless' • Defining Relative clauses • Non- Defining Relative clauses • Changing the focus of a sentence • Cohesion: Making connection in speech and writing
Unit 10: Free Writing	**Theory Time Hrs. 07**
Objectives	Contents
• Write free paragraphs • Write free and guided essays • Write Letters • Write technical and academic report	• Paragraph Writing • Essay Writing • Letter Writing • Report Writing (Technical and academic report)

• Compose Dialogues	• Making Dialogues
Unit 11: Comprehension Passage and Terminologies	**Theory Time Hrs. 03**
Objectives	Contents
• Answer the short questions based on the passage. • Define Common Medical Terminologies	• Passages related to Medical Issues • Common Medical Terminologies

Part : 2 Extensive reading (Literature)

The Magic of Words (collection of poetry, essays, prose)	**Theory Time Hrs. 50**
Objectives	Contents
Unit 1: Poems	**Theory hrs. (4*3 = 12)**
	My Heart Leaps Up When I Behold, William Wordsworth The Poplar Field, William Cowper Keeping Things Whole, Mark Strand On the Vanity of Earthly Greatness, Arthur Guiterman
Unit 2: Supernatural Stories	**Theory hrs. (4*3 = 12)**
	The Recurring Dream The Lost Doll The House Call The Loving Mother
Unit 3: Stories	**Theory hrs. (2*3 = 06)**
	A Worn Path, Eudora Welty The Gardener
Unit 4: Essays	**Theory hrs. (4*4 = 16)**
	Speaking of Children, Barbara Holland The Nightmare Life Without Fuel, Isaac Asimov Ooops! Hows' That Again, Roger Rosen Blatt The Six Million Dollar Man, Harold J. Morowitz
Unit 5: Drama/Play	**Theory hrs. 4**
	Malini, Rabindra Nath Tagore,

Recommended texts

1.Link English, Sajhaprakashan,

2. The Magic of Words (collection of poetry, essays, prose)

3. W. Dave (2011), Students Grammar, the University of Brigham, London; Harper Collins Publishers.

Evaluation Scheme:

This paper carries 100 (20 internal + 80 final) marks. The final assessment 80 marks will be divided as follows;

- Magic of Words: 25 Marks
- Link English: 10 Marks
- Student Grammar: 20 Marks
- Free Writing : 15 Marks
- Passage : 10 Marks

नेपाली

वर्ष : प्रथम **पाठघण्टा: १२०**

तह : प्रमाणपत्र/डिप्लोमा **मूल्याङकन अंक: १००**

आन्तरिक मूल्याङ्कन: २०

अन्तिम मूल्याङ्कन: ८०

यो पाठ्यांश प्रवीणता प्रमाणपत्र तहमा अध्ययन गर्ने विद्यार्थीहरूका लागि नेपाली भाषाको व्याकरणात्मक ज्ञान र सुझको विकासका साथै पठनबोध र अभिव्यक्ति क्षमताको विकास गर्ने दृष्टिले राखिएको हो । यसलाई मुख्यत: दुई खण्डमा बांडिएको छ: व्याकरण खण्ड र बोध (अभिव्यक्ति) खण्ड । व्याकरण अन्तर्गत वर्ण, वर्णविन्यास, शब्दवर्ग, रूपायन, शब्द निर्माण र वाक्यसम्बन्धी पाठ्यवस्तुहरू राखिएका छन् भने बोध/अभिव्यक्ति अन्तर्गत सामान्य बोध र प्रयोजनपरक बोधका साथै अभिव्यक्ति रचनाका लागि अपेक्षित सीपहरू र समीक्षाका लागि साहित्यिक विधाका पाठहरू समाविष्ट छन् ।

पाठ्यांशको उद्देश्य:

यो पाठ्यांश पूरा गरेपछि विद्यार्थीहरू निम्नलिखित कुरामा सक्षम हुनेछन् :

१. कथ्यभाषा र लेख्यभाषाका बीचको भिन्नता पहिल्याउन ।
२. अभिव्यक्तिमा प्रयोग हुने शब्दहरूको उपयुक्त वर्णविन्यास लेख्न ।
३. शब्दहरूका स्रोत, बनोट र वर्ग-पहिचान गर्न, रूपायन गर्न र निर्माण गर्न ।
४. वाक्यतत्व र वाक्यान्तरणका कडीहरू बुझेर आफ्ना अभिव्यक्तिमा तिनको उपयुक्त प्रयोग गर्न ।
५. खास वाक्यतत्वसंग सम्बद्ध ढांचा र सन्दर्भका आधारमा अनुच्छेद रचना गर्न ।
६. स्तर अनुरूप पाठ्यसामग्रीमा प्रयुक्त शब्दहरूका आधारमा शब्दभण्डारको विस्तार गर्न ।
७. बोध र संक्षेपीकरणका पाठ्यसामग्रीमा प्रयुक्त शब्दहरूका आधारमा शब्दभण्डारको विस्तार गर्न ।
८. ज्ञान-विज्ञानका विभिन्न शीर्षकहरूमा स्वतन्त्र रूपमा अनुच्छेद र निबन्ध रचना गर्न ।
९. तोकिएका आधारमा साहित्यिक कृतिहरूको समीक्षा गर्न ।

खण्ड १: नेपाली व्याकरण

पाठघण्टा :६० पूर्णाङ्क : ५०

एकाइ	पाठ्य विषयको विवरण	पाठघण्टा	अङ्क
१.	**वर्ण र वर्णविन्यास :** (क) <u>उच्चार्य वर्णहरूको परिचय</u> : • स्वर र व्यञ्जन वर्णहरू • देवनागरी लिपि र उच्चार्य नेपाली वर्णहरू • नेपाली अक्षरहरूको संरचना, अक्षरीकरण र अक्षरसंख्या निर्धारण (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	८ ४	८
२.	**शब्दभण्डार:** **शब्दवर्ग, शब्दरूपायन र शब्दनिर्माण** • स्रोतका आधारमा शब्दहरूको परिचय, पहिचान र प्रकार • व्युत्पादनका आधारमा शब्दहरूको परिचय, पहिचान र प्रकार • शब्दवर्ग-नाम, सर्वनाम विशेषण, क्रियापद, नामयोगी, क्रियायोगी, संयोजक, विस्मयादिवोधक र निपातहरूको पहिचान- अभ्यास	१९	१२

३.	• शब्दरूपायन-नाम, सर्वनाम र विशेषणको लिङ्ग, वचन, आदर, कारकका आधारमा तथा क्रियापदको लिङ्ग, वचन, पुरूष, आदर, काल, पक्ष, भाव, वाच्य र अकरणका आधारमा शब्द रूपायनको अभ्यास । • शब्द निर्माण अभ्यास • निम्नलिखित उपसर्गहरूद्वारा 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 प्रत्ययहरूद्वारा शब्दनिर्माणको अभ्यास : आइ, आली, इया, इलो, ई, ए, एली, ली, ले । इक, ई, ईय, इत, ता, त्व, मान, वान, आलु । • समस्त शब्दहरूको पहिचान र तत्पुरूष, कर्मधारण, द्विगू, द्वन्द्व, अव्ययीभाव, र वहूब्रीहिको प्रक्रियाबाट समस्त शब्दहरूको निर्माण गर्ने अभ्यास	१९	२०
	वाक्यतत्त्व, वाक्यान्तरण (क) वाक्यत्तत्वः उद्देश्य र विधेयको पहिचान • क्रिया र यसका प्रकार • वाक्यका प्रकारः सरल र जटिल वाक्यको पहिचान • वाक्य संश्लेषण र विश्लेषण • लिङ्ग, वचन, पुरूष र आदरका आधारमा कर्ता र क्रियापदका बीचको सङ्गति सम्बन्धी अभ्यास • विशेष्य र विशेषण र नाम र सर्वनामको बीचको सङ्गति सम्बन्धी अभ्यास • विभक्तिनियम तथा ले, लाई, देखि, बाट, द्वारा, को, का, की, रो, रा, री, नो, ना, नी, मा आदि विभक्ति प्रयोगको अभ्यास • सरल र तिर्यक् विभक्ति नियमको अभ्यास	१०	१०
	(ख) **वाक्यान्तरण :** • विभिन्न काल, पक्ष, भाव, अकरण, वाच्य, प्रेरणार्थक, उक्ति आदिमा वाक्यान्तरण गर्ने अभ्यास		

खण्ड खः बोध तथा अभिव्यक्ति

पाठघण्टा : ६० **पूर्णाङ्क : ५०**

एकाइ	पाठ्य विषयको विवरण	पाठघण्टा	अङ्क
१.	**बोध र शव्दभण्डार** चिकित्सा विज्ञानसम्बन्धि गद्यांशहरूको बोध र शब्दभण्डारको अभ्यास **चिकित्सा, शल्य चिकित्सा तथा स्वास्थ्य विज्ञानसम्बन्धी प्राविधिक शब्दहरूको ज्ञान अभ्यास (अर्थ लेख्ने र अर्थ खूल्ने गरी वाक्यमा प्रयोग गर्ने)** इन्द्रलुप्त, उत्क्लेस, ज्वर, पाण्डुरोग, प्रमेह, मधुमेह, पित्तदोस, प्रदर (१. रक्तपदर, २. स्वेतप्रदर) क्षयरोग, नशच्छेदन, रक्तचाप, उच्च रक्तचाप, न्यून रक्तचाप, गर्भपात/पतन, हृदयरोग, पाचनक्रिया, पित्तविकार, रक्तविकार, चिकित्सा, निदान, परिचारिका, प्रसववेदना, प्रसुति, औषधालय,	१२	१२

	चिरफार, बहिरंग, हिक्का, हरिताल पार्नु, हरिनाश, हियो उठ्नु, वातज्वर, सिफर पल्टिनु, सिङ्गारू, सेपाउनु, सप्को गर्नु, सन्निपात, सभिपात, शल्य चिकित्सा, शूल, शल्योपचार, मासु फरफराउनु, माथा विग्रनु, माटे, माई, भूंग्रेज्वरो, बेर्नु निस्कनु, बालतोड, बाथ, बान लाग्नू, बाउंडिनु, बहलाग्नु, बमन, विरेचन, फुस्रिनु, फुलो पर्नु, फाकफुक, पौंठा बस्नु, पेट बटारिनु, पेट काट्नु, पेट पोल्नु, पिनाश, पाछ्नु, निसलोठ, धम्की, दोख, दमै खटिरो, दम, डकार्नु, ठेउला, झुसिलो डकार आउनु, झिजो मान्नु, झाडा, जिरिङ्ग 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, कुंजो, कांसो लाग्नु, कास, काम्नु, कामज्वर, कांडो, कांध लाग्नु, काई लाग्नु, कब्जियत, औसनी लाग्नु, औडाहा चल्नु, ओछ्यान पर्नु, ओखत मुलो, ओइलाउनु, ऐंठन, उभर्को लाग्नु, उदररोग, उपर्तली, उकुच पल्टनु, अर्बुद, अजीर्ण, अपस्मार, आन्द्रा बटार्नु, आंत, आंठी गांठी, आंठे, आङ् चल्नु, आक्तो, आउं, अरूची, अम्मल, अमल पित्त, अमन हुनु, अग्नी जाग्नु, अतिसार, अंधो खटिरा, स्वेदन ।		
२	**संक्षेपीकरण** : • बुंदा टिपोट तथा संक्षेपीकरण गर्ने अभ्यास • अनुच्छेद, पत्र, निवेदन, विज्ञापन र प्रतिवेदन लेखन • ज्ञान विज्ञान र प्रविधिसंग सम्बन्धित विभिन्न विषय शीर्षकहरूमा अनुच्छेद लेख्ने अभ्यास	४	४
३	**निवन्ध लेखन** : • निबन्ध योजना र सोसंग सम्बन्धित बुंदा अनुरूप अनुच्छेद गठनको अभ्यास • वस्तुपरक र भावपरक निवन्ध लेखनको अभ्यास	१०	८
४	**कृति समीक्षा** : विषयवस्तु, कथानक, पात्र, परिवेश, सन्देश, शीर्षक र भाषा शैलीका आधारमा निम्नलिखित रचनाहरूको समीक्षात्मक अभ्यास: कथा : • गुरू प्रसाद मैनाली — छिमेकी • विश्वेश्वरप्रसाद कोइराला — सिपाही • इन्द्रबहादुर राई — रातभरि हुरी चल्यो • रमेश विकल — मधुमालतीको कथा निवन्ध : • लक्ष्मी प्रसाद देवकोटा — पहाडी जीवन • शंकर लामिछाने — एक पत्र सम्पादकलाई • भैरव अर्याल — महापुरूषको संगत कविता : • लेखनाथ पौडेल — नैतिक दृष्टान्त	३४	२६

	• पारिजात	मानूषी		
	• गोपाल प्रसाद रिमाल	आमाको सपना		
	• माधव प्रसाद घिमिरे	नेपालै नरहे		
	नाटक :			
	• विजय मल्ल	बहुला काजीको सपना		

द्रष्टव्य :
२० प्रतिशत अङ्क आन्तरिक मूल्याङ्कनका लागि छुटचाइएको छ भने ८० प्रतिशत अङ्क अन्तिम मूल्याङ्कनका लागि छुटचाइएको छ।

<u>सहायक पूस्तकहरू (सम्बद्ध अंश मात्र)</u>:

- मोहनराज शर्मा, शब्द रचना र वर्ण-विन्यास वाक्यत्तत्व र अभिव्यक्ति, काठमाण्डौ बुक सेन्टर, काठमाण्डौ
- चित्र कुमार गुरूङ्ग एम्.एस्सी.र केदार न्यौपाने एम्.ए., प्राविधिक शब्दार्थावली (चिकित्सा तथा विज्ञान खण्ड), त्रिभुवन विश्वविद्यालय, चिकित्सा शाश्त्र अध्ययन संस्थान, अनुसन्धान शाखा, महाराजगंज, काठमाण्डौ ।
- त्रि.वि. पाठ्यक्रम विकास केन्द्र, अनिवार्य नेपाली शिक्षण निर्देशन, काठमाण्डौ
- सागरमणि पाण्डेय, ईश्वरी पाण्डेय, अनिवार्य नेपाली, रत्नसागर प्रा.लि., काठमाण्डौ
- टीकाहरि बराल र अन्य, सीटीइभीटी अनिवार्य नेपाली ।

Social Studies

Year **First** **Total Hours: 80**

Level **Certificate** **Full Marks: 50**

Course Description

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

Course Objectives

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

- Identify the climate, geography, natural resources and administrative units of Nepal.
- Summarize the history of Nepal.
- Describe the arts and cultural achievements of Nepal.
- Explore the social problems challenging Nepal 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.

Evaluation : written exams

Course: Social Studies	**Hrs. theory 80**	**Marks: 50**
Unit: 1 Introduction		
Sub-unit 1.1: The land of Nepal	**Hrs. theory 10**	**6**
Objectives:	Content:	
• Describe the geographical divisions of Nepal. • Identify the administrative units of Nepal. • Compare the ecological, climatic, and regional diversities in Nepal. • Describe the natural resources 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.	
Unit 2: Political History of Nepal	**Hrs. theory 16**	**10**
Sub-unit 2.1: Ancient and medieval Nepal	**Hrs. theory 6**	
Objectives:	Content:	
• Discuss the historical events of the ancient period. • Explain why the period of Lichhavi rule is known as the golden period. • Summarize the brief history of Doya, Khash and Malla kingdoms.	Ancient Nepal: • Origin of the word "Nepal" • Ancient dynasties: Gopal, Mahispal, Kirat • Licchavi period (Licchavi civilization).	

	Medieval Nepal: • Doya Rajya or Karnatac • Kasha kingdom of Karnali region • Malla kingdom of Kathmandu valley	
Sub-unit 2.2: Unification of Nepal	**Hrs. theory 5**	
Objectives:	Content:	
• Describe the geographical fragmentation of Nepal in the later medieval period. • Identify the causes of geographical fragmentation. • Explain the political, social, economic and geographical situation of Nepal before the enthronement of Prithvi Narayan Shah. • Analyse the policies adopted by Prithvi Narayan Shah and his successors during the time of unification. • Identify the factors which influenced the rise of the Ranas.	• Petty states of Nepal (Baisi, Chaubisi), states in Kathmandu valley, three Sena states of eastern Nepal. • Political, social, economic and geographical conditions of Nepal before Prithvi Narayan Shah. • Unification of Nepal: role of Prithvi Narayan Shah, Rajendra Laxmi, Bahadur Shah, and Bhim Sen Thapa. • Political instability and the factors which influenced the rise of Jang Bahadur: o Conspiracies, o Assassinations, o Kot Massacre, o Bhandarkhal Parva, o Alau Parva.	
Sub-unit 2.3: Peoples' Movements and Rise of democracy	**Hrs. theory 5**	
Objectives:	Content:	
• Assess the improvement works of the first elected government of Nepal. • Examine the people's movement of 2046 B.S. and its impacts. • Examine the characteristics of the constitution of Nepal , 2047BS & 2072BS. • Discuss the impact of people's second movement on the social conditions of Nepal.	• The first elected government of Nepal 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 3: Society & Culture	**Hrs. theory 14**	**10**
Sub-unit 3.1: Development of Nepalese culture and society	**Hrs. theory 7**	
Objectives:	Content:	
• Analyze the population growth of Nepal: • Describe the contributing factors of population growth. • Describe the origin of the caste system in Nepal • Analyze the current laws about cast practice.	• Population growth in Nepal • Contributing factors of population growth: fertility, mortality, and migration. • Caste beliefs and constitutional provision. • Establishment of national languages	

• Discuss the establishment national languages. • Identify different ethnic languages and culture. • Identify the social problems of Nepal:	• Ethnic languages and culture: o Nepali o Newari o Sanskrit o Maithili Social problems: • Poverty • Gender issues • Unemployment • Drug addictions • HIV/AIDS • Prostitution • Child labor • Trafficking • Other	
Sub-unit 3.2: Arts and religion	**Hrs. theory 7**	
Objectives:	Content:	
• Analyze the cultural heritage of Nepal. • Discuss the development of arts in Nepal. • Explain the history of religious harmony in Nepal.	Cultural heritages in Himalayan, Hilly and Terai regions: • Food habits • Dress and ornaments • Festivals and temples • Music, songs and dances • Occupations Art in Nepal: • Paintings, sculpture and architecture in ancient, medieval and modern times. Religions in Nepal: • Hinduism • Buddhism • Muslim • Kirat • Christian	
Unit 4: Nepalese Economy	**Hrs. theory 14**	**8**
Sub-unit 4.1: Resources and development	**Hrs. theory 7**	
Objectives:	Content:	
• Analyse the affecting factors of Nepalese economic development. • Explain the various features of Nepal's economic system.	Affecting factors for the Nepalese economy: • Poverty, • Inequality, • Population growth • Unemployment, • Regional disparities • Land tenures. Features of the Nepalese economic system: • Agriculture and land reform system • Cottage and large scale industries	

	• Internal and external trade • Tourism • Cooperation • Planned economy • Mixed economy (capitalism and socialism)	
Sub-unit 4.2: Natural resources	**Hrs. theory 7**	
Objectives:	Content:	
Explain the resources for the economic development.	Resources of national development: • Human resources • Forests • Land • Water • Minerals	
Unit 5: Politics and Government	**Hrs. theory 14**	**8**
Sub-unit 5.1: Democratic constitution	**Hrs. theory 2**	
Objectives:	Content:	
Define democracy • Distinguish between a democratic and non-democratic form of government. • Explain the salient features of the constitution of Nepal 2047 and 2072 B.S.	Meaning and definition of democracy; • Characteristics of democratic government; • Features of the constitution of 2047 and 2072BS.	
Sub-unit 5.2: Federalism	Hrs. theory 7	
• Explain the structure of the state and distribution of power. • Explain the Civic duties and responsibilities for the successful implementation of the constitution of Nepal.	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 5.3: Provincial Legislature and Provincial Executive	**Hrs. theory 5**	
• Explain the structure of local excecutive. • Explain the Interrelationship between the Federation provinces and local level.	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 6: Foreign Policy	**Hrs. theory 12**	**8**
Objectives:	Content:	
• Explain the characteristics of Nepal's foreign policy. • Explain Nepal's foreign policy with special reference to her relations with India and China. • Describe Nepal's role in the peacekeeping process of UNO. • Assess the importance of regional cooperation: SAARC.	Nepal's foreign policy: • Geographical • Historical • Cultural • Economic • International. Features of Nepal's foreign policy: • Non-aligned • Panchasila • Acceptance of UNO charter • Regional cooperation • Peace movement • Disarmament • Others Nepal's relations with its neighbors: • China • India • UNO Foundation of SAARC; Nepal's role for the development of the SAARC countries.	

References

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

Anatomy and Physiology

Year : **First** **Credit Hours: Theory 160**
Level : **Certificate** **Practical: 40**
Assessment Marks: 100

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 the pathology and clinical features of medical and surgical conditions, diseases and disorders, as well as the rationale for treatments and management.

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

- Identify the classifications of the systems of the human body.
- Locate and describe the structure and function of the components of each body system.
- Explain the interrelationship of the body systems.
- Transfer knowledge of anatomy and physiology of the body to medical and surgical circumstances.
- Explain the mechanisms of body repair and resistance to disease.
- Describe the physical changes that occur during normal growth and development, from conception to senescence.

Recommended Text

1. *Amatya Dr. Mrigendra,* A Text Book of Anatomy and Physiology , 2nd edition
2. *Pal, G.K. & Pal, Pravati,* Text Book of Practical Physiology, Publised by Orirnt Longman Private Limited, Chennai, India
3. A Text Book of Anatomy and Physiology , 2nd edition, Dr. Mrigendra Amatya,
4. Text Book of Practical Physiology, *By G.K. Pal & Pravati Pal,* Publised by Orirnt Longman Private Limited, Chennai, India

Reference Texts

1. Shier, D., Butler, J. & Lewis, R., Hole's Human Anatomy and Physiology. Wm. C. Brown Publishers, London. 1996 or current edition.
2. Chauarasia, Handbook of Human Anatomy. CBS Publication. Current edition.

Part I: Anatomy

Course: Anatomy	**Hrs. theory 80 Hrs. tutorial 20**
Unit 1: Introduction of Anatomy	**Hrs. theory 5 Hrs. tutorial 1**
Objectives:	Content:
1. Define anatomy and relation between anatomy and physiology 2. Describe the locations of each main body cavity and list the organs within each cavity. 3. Name the organ systems, tell the function of each system, and list the organs associated with each system. 4. Define the terms that describe body positions, 5. body sections, and body regions. 6. Review the general characteristics of cell structure, function, and reproduction. 7. Describe the general characteristics and functions of the body tissues: epithelial,	1. Concepts of anatomy: the homeostatic, integrated, self-healing nature of body cells and tissues. 2. Organization of the human body. 3. Review of cellular and tissue characteristics, functions. 4. Anatomical terms: • Cardiovascular • Digestion • Excretion • Organ • Peritoneal • Pericardial • Physiology

cartilage, connective, bone, nerve, adipose and three kinds of muscle tissue.	• Thoracic • Visceral
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub unit 2.1: Skin and integumentry system	**Hrs. theory 4 Hrs. tutorial 1**
Objectives:	Content:
1. Describe the four chief types of membranes. 2. Describe the structure of the various layers of the skin with diagram. 3. Describe the location and function of the accessory organs located within the layers of skin. 4. Summarize the factors that determine skin color.	1. Types of membranes. 2. Layers of the skin. 3. Accessory organs and glands of the skin.
Evauation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.2: Skeletal system	**Hrs. theory 6 Hrs. Practical 2**
Objectives:	Content:
1. Describe the chief functions of bones. 2. Classify bones according to their shape and give an example from each group. 3. Describe the structure of a bone and tell the function of each parts 4. Differentiate between intramembranous and endochondral bones and tell how each type of bone grows and develops. 5. Differentiate between axial and appendicular skeletons and name the major bones of each system. • Identify and label long, short and flat bones. 6. Locate and identify the bones that comprise the skull, vertebral column, thoracic cage, pectoral girdle, upper limb, pelvic girdle, and lower limb. 7. Locate and identify the features of these bones.	1. Structure of bone. 2. Bone growth and development. 3. Skeletal organization. 4. Identification and labeling of long, short and flat bones. 5. Terms related to the skeletal system: • axial • appendicular • articular cartigage • diaphysis • epiphysis • fontanel • hematopoiesis • marrow • periosteum
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.3: Skeletal joints	**Hrs. theory 3 Hrs. Practical 2**
Obectives:	Content:
1. Describe how joints can be classified according to the type of tissue that holds them together. 2. Describe how bones are held together in fibrous joints and cartilaginous joints.	1. Classifications of joints: fibrous, cartilaginous, synovial. 2. Types of joint movement. 3. Structure and types of synovial joints. 4. Terms related to joints:

3. Describe the structure of a synovial joint. 4. List six types of synovial joints and give an example of each type. 5. Describe these joints and explain how the 6. articulation parts are held together: • Shoulder • elbow • hip • knee • ankle • wrist	• articulation • bursa • ligament • suture • symphysis
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.4: Muscular system	**Hrs. theory 4 Hrs. Practical 1**
Objectives:	Content:
1. Name the chief parts of a skeletal muscle fiber. 2. Distinguish between the structures and functions of skeletal, cardiac and smooth muscles. 3. Identify and describe the locations of the chief skeletal muscles and describe the action of each muscles of facial expression and mastication muscles that move the: • head • pectoral girdle • arm • forearm • hand • abdominal wall • pelvic outlet • thigh • leg • foot	1. Structure of a skeletal muscle: 2. connective tissue coverings 3. skeletal muscle fibers
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.5: Nervous system	**Hrs. theory 3 Hrs. Practical 1**
Objectives:	Content:
1. Describe the structure of a neuron. 2. Explain how neurons are classified. 3. Describe a reflex arc.	1. Classifications of neurons and neuralgia. 2. Nerve pathways. 3. Reflex arc. 4. Terms related to the nervous system: • axon • central nervous system • dendrite • effector • myelin

	• neuroglia • neuron • neuroratansmitter • receptor • reflex • synapse
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.6: Components of the nervous system	**Hrs. theory 3 Hrs. Practical 1**
Objectives:	Content:
1. Describe the coverings of the brain and spinal cord. 2. Describe the structure of the spinal cord. 3. Locate the chief parts of the brain . 4. Locate the motor, sensory, and association areas of the cerebral cortex. 5. Describe the formation and storage of cerebrospinal fluid 6. Locate the chief components of the peripheral nervous system. 7. Describe the structure of a peripheral nerve. 8. Describe the location and function of each of the cranial and spinal nerves.	1. Divisions of the central nervous system: • meninges • spinal cord • brain 2. Structure and function of the cerebrum. 3. Ventricles and cerebrospinal fluid 4. Divisions of the peripheral nervous system: • cranial nerves • spinal nerves 5. Terms related to the nervous system: • adrenergic • brain stem • cerebellum • cerebral cortex • cerebral hemisphere • cerebrum • cholinergic • hypothalamus • medulla oblongata • meninges • midbrain • parasympathetic • reticular formation • sympathetic • thalamaus • ventricle • Reflex-Deep tendon reflex and superficial reflex
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.7: Somatic and special senses	**Hrs. theory 3 Hrs. Practical 1**
Objectives:	Content:

1. Name five kinds of sensory receptors and explain the function of each 2. Locate and name the parts of the ear and explain the function of each parts. 3. Name the parts of the eye and explain the function of each parts.	1. Functions of receptors and sensations. 2. Olfactory organs: location and functions. 3. Auditory organs: location, function of parts the middle, inner and external ear. 4. Terms related to senses: • accommodation • ampulla • chemoreceptor • cochlea • cornea • dynamic/static equilibrium • labyrinth • macula • optic • photoreceptor • proprioreceptor • referred pain • retina • sclera • thermoreceptor
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.8: Endocrine system	**Hrs. theory 6 Hrs. Practical 1**
Objectives:	Content:
1. Differentiate between endocrine and exocrine glands. 2. Name and locate the chief endocrine glands and tell the hormones they secrete. .	1. Characteristics f the endocrine system. 2. Structures, functions and locations of endocrine glands: • pituitary • thyroid • parathyroid • adrenal • pancreas • thymus • ovary/testes/placenta • pineal 3. Terms related to endocrine system: • adrenal cortex • adrenal medulla • aldosterone • anterior pituitary • epinepherine • catacholamine • glucagon • luteinizing hormone • metabolic rate • norepinepherine • prolactin • prostaglandin • steroid • thyroxine

Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.9: Blood	**Hrs. theory 3 Hrs. Practical 1**
Objectives:	Content:
1. Describe the characteristics of the blood and tell the functions of blood 2. Differentiate between the different types of blood cells	1. Components and function of the blood.
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.10: Cardiovascular system	**Hrs. theory 6 Hrs. Practical 1**
Objectives:	Content:
1. Name the organs of the cardiovascular system and describe their functions 2. Locate and name the major parts of the heart and describe the functions of each. 3. Describe the pathway of the blood through the heart and the vessels of the coronary circulation. 4. Compare the structures of the chief blood vessels of the body. 5. Compare the pulmonary and systemic pathways of the cardiovascular system 6. Identify and locate the chief arteries and veins of the pulmonary and systemic systems.	1. Structures and functions of the heart. 2. Locations, functions and characteristics of arteries and arterioles. 3. Capillaries and their actions. 4. Locations, functions and characteristics of veins and venules. 5. Names, functions and locations of the vascular components of the pulmonary and systemic circulatory systems. 6. Terms related to circulation: • arteriole • atrium • cardiac cycle • cardiac output • diastolic pressure • electrocardiogram • myocardium • pericardium • peripheral resistance • sphygmomanometer pacemaker • systolic pressure • vasoconstriction • vasodilation • ventricle • venule • viscosity
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.11: Lymphatic system and immunity	**Hrs. theory 3 Hrs. Practical 1**
Objectives:	Content:

1. Describe the functions of the lymphatic system and locate the chief lymphatic pathways. 2. Locate the chief lymph nodes and describe their functions.	1. Patterns of Lymphatic movement. 2. Lymph node location, function and structure. 3. Terms related to lymphatics and immune system: • allergen • antibody • antigen • interferon • lymphocyte • macrophage • pathogen • vaccine
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.12: Digestive system	**Hrs. theory 7 Hrs. Practical 1**
Objectives:	Content:
1. Locate and describe the functions chief organs of the digestive system. 2. Name the parts of the stomach, liver and gall bladder, large and small intestine. 3. Describe the structure of the wall of the alimentary canal. 4. List the enzymes of secreted by various digestive organs and glands .	1. Structures and functions of the alimentary canal. 2. Movement and enervation f the alimentary canal. 3. Mouth structures and functions. 4. Pharynx and esophagus structure and function. 5. Structure and functions of the pancreas and liver in regard to digestion. 6. Structure and function of the small and large intestines. 7. Terms related to the digestive system: • absorption • anal canal • bile • chyme • deciduous • duodenum • emulsification • feces • jejunum • ilium • mesentery • mucous membrane • panacreatic juice • peristalsis • pyloric sphinctor • rectum • sphincter muscle • vermiform appendix • villi/villus

Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.13: Respiratory system	**Hrs. theory 6 Hrs. Practical 1**
Objectives:	Content:
1. Describe the functions of the respiratory system 2. Locate the organs of the respiratory system 3. Explain how inspiration and expiration are achieved. 4. Locate the respiratory center and explain how it controls normal breathing. 5. Describe the functions of the respiratory membrane.	1. Organs of the respiratory system. 2. Terminology related to respiration: • alveolus • bronchial tree • diaphragm • glottis • intercostal muscles • hilus • hyperventilation • oxyhemoglobin • parietal pleura • partial pressure • pleural cavity • respiratory membrane • respiratory volume • surface tension • surfactant • visceral pleura
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.14: Urinary system	**Hrs. theory 5 Hrs. Practical 1**
Objectives:	Content:
1. Locate the organs of the urinary system and describe their general function 2. Describe the structure and functions of the kidneys. 3. Describe the pathway of blood through the kidneys. 4. Describe a nephron and explain the function of each parts . 5. Describe the structure of the ureters, urinary bladder, and urethra. .	1. Location, structure and function of the organs of the urinary system. 2. Renal circulation. 3. Terms related to the urinary system: • renal cortex • renal medulla • glomerulus • afferent arteriole • efferent arteriole • juxtaglomerular apparatus • nephron loop • pertibular capillary • renal corpuscle • renal tubule • renal plasma threshold • retroperitoneal • autoregulation • destusor muscle
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.15: Male reproductive system	**Hrs. theory 4 Hrs. Practical 1**

Objectives:	Content:
1. Name the parts of the male reproductive system and describe the general functions of each. 2. . Describe the path of sperm sells from their origin to their exit from the body 3. Describe the structure of penis and explain the mechanism of erection and ejaculation. 4. Describe how a vasectomy is performed, and discuss the relative simplicity of this procedure.	1. Structure and function of the external organs: penis, testes, scrotum. 2. Internal accessory organs: epididymis, vas deferens, seminal vesicle, prostate gland, bulbourethral glands, 3. Terms related to male reproductive system: • glans penis • prepuce • corpora cavernosa • corpus cavernosa • spermatogenesis • semen • inguinal • gonadotropin • testosterone
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. tutorial**
Sub-unit 2.16: Female reproductive system	**Hrs. theory 4 Hrs. tutorial 1**
Objectives:	Content:
1. Name the parts of the female reproductive system and describe the general functions of each.	1. Structure and function of the vagina, clitoris, labia,ovaries, fallopian tubes, uterus, breasts and mammary glands. 2. Fertilization and embryonic development. 3. Terms related to the female reproductive system: • follicle • estrogen • progesterone • fertilization • meiosis • oogenesis • zygote • implantation • infundibulum • orgasm • ovulation • menstrual cycle • puberty and menarche • placenta • menopause
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 3: Human Growth & Development	**Hrs. theory 5 Hrs. Practical 1**
Objectives:	Content:
1. Describe the process of development from conception through the embryonic stage.	1. Embryionic and foetal development. 2. Terms related to growth and development: • amnion

2. Describe the formation and function of the placenta. 3. Define the term foetus and describe the foetal stage of development. 4. Describe the path of blood through the foetal circulatory system.	• chorion • zygote • embryo • foetus • placenta • umbilical cord • prenatal • neonatal • postnatal
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.

Part II: Physiology

Course: Physiology	**Hrs. theory 80 Hrs. tutorial 20**
Unit 1: Introduction of Physiology	**Hrs. theory 2 Hrs. tutorial 1**
Objectives:	Content:
1. Define physiology and relation between anatomy and physiology. **2.** List and describe the chief characteristics of life and the chief requirements of living organisms. 3. Define homeostasis and discuss its importance for survival. 4. Name the organ systems, tell the function of each system, and list the organs associated with each system. 5. Review the general characteristics of cell structure, function, and reproduction. 6. Describe the general characteristics and functions of the body tissues: epithelial, cartilage, connective, bone, nerve, adipose and three kinds of muscle tissue.	1. Concepts of physiology: the homeostatic, integrated, self-healing nature of body cells and tissues. 2. Organization of the human body. 3. Review of cellular and tissue characteristics, functions. 4. Physiological terms: • Cardiovascular • Digestion • Excretion • Organ • Peritoneal • Pericardial • Physiology • Thoracic • Visceral • Homeostasis • Yoga • Aging
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub unit 2.1: Skin and integumentry system	**Hrs. theory 3 Hrs. Practical 1**
Objectives:	Content:
1. Describe the function of each layer of skin. 2. Describe the location and function of the accessory organs located within the layers of skin. 3. Explain how the skin regulates body temperature. 4. Summarize the factors that determine skin color	1. Thermoregulatory function of the skin. 2. Pigmentation. 3. Healing of wounds, burns; skin disorders.
Evauation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.2: Skeletal system	**Hrs. theory 4 Hrs. Practical 1**
Objectives:	Content:
1. Describe the chief functions of bones. 2. Describe the structure of a bone and tell the function of each parts 3. Discuss the effects of hormones , sunlight, and exercise on bone development.	1. Functions of bone: 2. support/protection 3. body movement 4. blood cell formation 5. Bone growth and development. 6. Factors affecting growth and repair. 7. Skeletal organization.

Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.3: Skeletal joints	**Hrs. theory 3 Hrs. Practical 1**
Obectives:	Content:
1. Describe the functions of different types of Joint. • Shoulder • elbow • hip • knee • ankle • wrist 2. Explain how skeletal muscles produce movements at joints and give examples of different kinds of movement. 3. Describe the function of the fontanels?	1. Explanation how skeletal muscles produce movements at joints and give examples of different kinds of movement. 2. Terms related to joints: • Shoulder • elbow • hip • knee • ankle • wrist 3. Function of the fontanels
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.4: Muscular system	**Hrs. theory 3 Hrs. Practical 1**
Objectives:	Content:
1. Name the chief parts of a skeletal muscle fiber. 2. Differentiate between fast and slow muscles and between twitch and sustained contraction. Name the chief parts of a skeletal muscle fiber and describe the function of each part. 3. Describe the process of muscle contraction. Explain how muscle contractions produce body movement and maintain posture. 4. Distinguish between the structures and functions of skeletal, cardiac and smooth muscles.	1. Structure of a skeletal muscle: • skeletal muscle fibers • neuromuscular junction • motor units 2. Skeletal muscle contraction: • role of myosi and actin • stimulus for contraction • muscular responses 3. Smooth muscle fibers and contraction. 4. Cardiac muscle fibers and contraction. 5. Actions of the muscles of the skeletal system: 6. Terms related to the muscular system: • antagonist • fascia • insertion • motor neuron • muscle impulse • neurotransmitter • origin • synergist
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.5: Nervous system	**Hrs. theory 2 Hrs. Practical 1**
Objectives:	Content:

1. Describe the structure of a neuron. 2. Explain how neurons are classified. 3. Describe a reflex arc. 4. Explain the general functions of the nervous system 5. Describe the events that lead to the conduction of a nerve impulse. 6. Explain how a nerve impulse is transmitted from one neuron to another. 7. Explain what is meant by reflex behavior.	1. Classifications of neurons and neuralgia. 2. cell membrane function. 3. Synapse function. 4. Neurotransmitters and neuropeptides. 5. Impulse processing. 6. Nerve pathways. 7. Reflex function. 8. Terms related to the nervous system: • axon • central nervous system • dendrite • effector • myelin • neuroglia • neuron • neuroratansmitter • receptor • reflex • synapse
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.6: Components of the nervous system	**Hrs. theory 3 Hrs. Practical 1**
Objectives:	Content:
1. Locate the chief components of the peripheral nervous system. 2. Describe the structure of a peripheral nerve. 3. .Describe the structure of the spinal cord. 4. Locate the chief parts of the brain 5. Explain the meaning of hemisphere dominance. 6. Mention the chief functions of Spinal cord. 7. Describe the functions of each part of brain. 8. Describe the stages of memory storage. 9. Describe the formation and storage of cerebrospinal fluid 10. Describe the composition and function of Cerebrospinal fluid. 11. Describe the functions of the limbic system and reticular formation. 12. Locate the chief components of the peripheral nervous system. 13. Describe the location and function of each of the cranial and spinal nerves. 14. Compare the functions of the sympathetic and parasympathetic divisions of the autonomic nervous system.	1. Structure and function of the cerebrum. 2. Effects of cerebral injury. 3. Divisions of the peripheral nervous system: 4. Cranial nerves and its test 5. Spinal nerves 6. Functions of the autonomic nervous system. 7. Terms related to the nervous system: • adrenergic • brain stem • cerebellum • cerebral cortex • cerebral hemisphere • cerebrum • cholinergic • hypothalamus • medulla oblongata • meninges • midbrain • parasympathetic • reticular formation • sympathetic • thalamaus • ventricle 8. Reflex-Deep tendon reflex and superficial reflex

Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.7: Somatic and special senses	**Hrs. theory 3 Hrs. tutorial 1**
Objectives:	Content:
1. Name five kinds of sensory receptors. explain the function of each 2. Locate and name the parts of the earand explain the function of each parts. 3. Name the parts of the eye and explain the function of each parts. 4. Differentiate between static and dynamic equilibrium. 5. Explain the function of each sensory receptors. 6. Explain how the receptors stimulate sensory impulses. 7. Describe how sensation is produced. 8. Describe how the sense of pain is produced. 9. Explain the function of each parts of the ear. 10. Explain the functions of each parts of the Eye.. 11. Describe the visual nerve pathway.	1. Functions of receptors and sensations. 2. Function of the somatic senses: touch/pressure, temperature, stretch, pain. 3. Olfactory organs: location and functions. 4. Taste perception. 5. Auditory organs: location, function of parts the middle, inner and external ear. 6. Processes of equilibrium. 7. Function of visual organs: • visual accessory organs • structure of the eye • light refraction • visual nerve pathways 8. Terms related to senses: • accommodation • ampulla • chemoreceptor • cochlea • cornea • dynamic/static equilibrium • labyrinth • macula • optic • photoreceptor • proprioreceptor • referred pain • retina • sclera • thermoreceptor • Test of cranial nerves
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.8: Endocrine system	**Hrs. theory 8 Hrs. Practical 1**
Objectives:	Content:
1. Differentiate between endocrine and exocrine glands. 2. Explain how steroid and nonsteroid hormones produce effects on target cells. 3. Discuss how negative feedback mechanisms regulate hormonal secretions. 4. Explain how the nervous system controls hormonal secretions 5. Describe the functions of the hormones secreted by the endocrine glands.	1. Characteristics f the endocrine system. 2. Functions of hormones. 3. Control of hormone secretion. 4. Structures, functions and locations of endocrine glands: • pituitary • thyroid • parathyroid • adrenal • pancreas

6. Explain how the secretion of each hormone is regulated. 7. Distinguish between physical and psychological stress. 8. Describe the general stress response and its effects on the body when stress is continuous	• thymus • ovary/testes/placentapineal 5. Terms related to endocrine system: • adrenal cortex • adrenal medulla • aldosterone • anterior pituitary • epinepherine • catacholamine • glucagon • luteinizing hormone • metabolic rate • norepinepherine • prolactin • prostaglandin • steroid • thyroxine
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.9: Blood	**Hrs. theory 4 Hrs. Practical 2**
Objectives:	Content:
1. Describe the characteristics of the blood and tell the functions of blood 2. Differentiate between the different types of blood cells. 3. Explain the interpretation of blood cell counts. 4. Describe the production and control of red blood cells. 5. Tell the components of plasma and the function of each . 6. Define homeostasis and describe how it is maintained. 7. Describe the steps in blood coagulation Discuss factors which increase or interfere with blood coagulation 8. Explain the purpose and process of blood typing. 9. Describe how blood reactions may occur between the fetal and maternal tissues.	1. Components and function of the blood. 2. Differential interpretation of blood counts. 3. Role of blood in maintaining homeostasis. 4. Production and regulation of blood cells. 5. Coagulation factors. 6. Blood types and blood reactions. 7. terms related to the study of blood: albumin homeostasis antibody leukocyte antigen lymphocyte basophil macrophage embolus monocyte eosinophil neutrophil erythrocyte plasma erythropoeitin platelet fibrinogen thrombus globulin 8. WBC Count 9. RBC Count 10. DL Count 11. BT Count 12. CT Count 13. Blood grouping
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.10: Cardiovascular system	**Hrs. theory 6 Hrs. Practical 1**

Objectives:	Content:
1. Name the organs of the cardiovascular system and describe their functions 2. Locate and name the major parts of the heart and describe the functions of each. 3. Describe the pathway of the blood through the heart and the vessels of the coronary circulation. 4. Describe the cardiac cycle and tell how it is controlled. 5. Mention the functions of the chief blood vessels of the body 6. Compare the structures of the chief blood vessels of the body 7. Explain the mechanisms that aid in returning venous blood to the heart. 8. Explain how blood pressure is produced and controlled. 9. Compare the pulmonary and systemic pathways of the cardiovascular system	1. Structures and functions of the heart. 2. Interpretation of heart sounds. 3. Locations, functions and characteristics of arteries and arterioles. 4. Capillaries and their actions. 5. Locations, functions and characteristics of veins and venules. 6. Regulation of blood pressure. 7. Mechanisms of venous flow. 8. Names, functions and locations of the vascular components of the pulmonary and systemic circulatory systems. 9. Terms related to circulation: • arteriole • atrium • cardiac cycle • cardiac output • diastolic pressure • electrocardiogram • myocardium • pericardium • peripheral resistance • sphygmomanometer pacemaker • systolic pressure • vasoconstriction • vasodilation • ventricle • venule • viscosity • Precordium examination normal sound • Murmur • Measurement of pulse and blood pressure
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.11: Lymphatic system and immunity	**Hrs. theory 3 Hrs. Practical 1**
Objectives:	Content:
1. Describe the functions of the lymphatic system and locate the chief lymphatic pathways. 2. Explain how lymphatic circulation is maintained. 3. Locate the chief lymph nodes and describe their functions. 4. Differentiate between specific and nonspecific immunity and provide examples of each	1. Patterns of Lymphatic movement. 2. Lymph node location, function and structure. 3. Functions of the thymus and spleen. 4. Specific and nonspecific defenses against infection. 5. Immunity and allergic reactions. 6. Disorders with autoimmune origins: 7. Type 1 Diabetes • Lupus erythematosus

5. Describe the function of lymphocytes and immunoglobulins. 6. Differentiate between active and passive immunity. 7. Distinguish between primary and secondary immune responses. 8. Explain how allergic reactions, tissue rejection reactions, and autoimmunity are related to immune mechanisms. 9. Describe the disorders believed to be caused by an autoimmune reaction..	• Rheumatoid arthritis • Scleroderma • Multiple sclerosis • Schizophrenia 8. Terms related to lymphatics and immune system: • allergen • antibody • antigen • interferon • lymphocyte • macrophage • pathogen • vaccine
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.12: Digestive system	**Hrs. theory 6 Hrs. tutorial 1**
Objectives:	Content:
1. Locate and describe the functions chief organs of the digestive system. 2. Describe how the contents of the alimentary canal are moves and mixed. 3. Describe the functions of enzymes secreted by various digestive organs and glands . describe the function of each. 4. List the enzymes of secreted by various digestive organs and glands . 5. Describe how digestive secretions are controlled. 6. Discuss how digestive reflexes control movement of material through the alimentary canal. 7. Describe the mechanisms of swallowing, vomiting and defecating. 8. Explain how the products of digestion are absorbed.	1. Structures and functions of the alimentary canal. 2. Movement and enervation f the alimentary canal. 3. Mouth structures and functions. 4. Pharynx and esophagus structure and function. 5. Gastric secretions and absorption. 6. Structure and functions of the pancreas and liver in regard to digestion. 7. Structure and function of the small and large intestines. 8. Terms related to the digestive system: • absorption • anal canal • bile • chyme • deciduous • duodenum • emulsification • feces • jejunum • ilium • mesentery • mucous membrane • panacreatic juice • peristalsis • pyloric sphinctor • rectum • sphincter muscle • vermiform appendix • villi/villus

	• Vomiting, Diarrhoea, Constipation
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.13: Respiratory system	**Hrs. theory 7 Hrs. Practical 1**
Objectives:	Content:
1. Describe the functions of the respiratory system 2. Locate the organs of the respiratory system 3. Explain how inspiration and expiration are achieved. 4. Describe the respiratory cycle and define the related terms: tidal volume, inspiratory reserve, expiratory reserve, residual volume, vital capacity, inspiratory capacity, functional residual capacity, total lung capacity. 5. Locate the respiratory center and explain how it controls normal breathing. 6. Describe the various factors which affect the respiratory center. 7. Describe the functions of the respiratory membrane. 8. Explain how oxygen and carbon dioxide are transported in the blood. 9. Describe the process of cellular respiration. 10. Explain how cells use oxygen	1. Organs of the respiratory system. 2. Mechanisms of breathing and control of breathing. 3. Alveolar gas exchanges. 4. Gas transport. 5. Terminology related to respiration: • alveolus • bronchial tree • diaphragm • glottis • intercostal muscles • hilus • hyperventilation • oxyhemoglobin • parietal pleura • partial pressure • pleural cavity • respiratory membrane • respiratory volume • surface tension • surfactant • visceral pleura • Breath sound (Bronchial and vesicular • Measurement of Respiratory rate • Measurement of Chest Circumferance
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.14: Urinary system	**Hrs. theory 4 Hrs. Practical 1**
Objectives:	Content:
1. Locate the organs of the urinary system and describe their general function 2. Describe the structure and functions of the kidneys. 3. Describe the pathway of blood through the kidneys. 4. Describe a nephron and explain the function of each parts .	1. Location, structure and function of the organs of the urinary system. 2. Renal circulation. 3. Processes and regulation of urine formation: 4. glomerular filtration 5. tubular reabsorption 6. concentration and volume 7. Formation of urea, ureic acid.

5. Explain how glomerular filtrate is produced and state it's components. 6. Discuss the regulation of glomerular filtration and factors that may affect this. 7. Describe tubular reabsorption and tubular secretion, in the production of urine 8. Describe the functions of the ureters, urinary bladder, and urethra. 9. Describe the process of micturation and tell how it is controlled	8. Tubular secretion and urine composition. 9. Elimination of urine. 10. Terms related to the urinary system: • renal cortex • renal medulla • glomerulus • afferent arteriole • efferent arteriole • juxtaglomerular apparatus • nephron loop • pertibular capillary • renal corpuscle • renal tubule • renal plasma threshold • retroperitoneal • autoregulation • destusor muscle
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.15: Water, electrolyte & pH balance	**Hrs. theory 6 Hrs. Practical 1**
Objectives:	Content:
1. Discuss the importance of water and electrolyte balance within the human body. 2. Describe how body fluids are distributed within compartments, how fluid composition differs between compartments, and how fluids move from one compartment to another. 3. List the routes by which water leaves and enters the body. 4. Describe how water intake and output are regulated by the body systems. 5. List the important electrolytes of the body. 6. List the ways electrolytes enter and leave the body 7. Explain the meaning of acid-base balance within the body. 8. Discuss the regulation of how electrolytes enters and leaves the body. 9. Dercribe where hydrogen ions come from within the body. 10. Describe the action of the body's chemical buffer systems, respiratory center, and the kidneys in regulating acid-base balance.	1. Composition of body fluids. 2. Distribution and movement of fluids between compartments. 3. Mechanisms of water balance and regulation. 4. Mechanisms of electrolyte balance and regulation. 5. Regulation of hydrogen ion concentration. 6. Terms related to water and electrolyte balance: • acidosis • alkalosis • bicarbonate buffer system • phosphate buffer system • protein buffer system • extracelllular • intracellular • transcellular • osmoreceptor • electrolyte balance
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory Hrs. Practical**
Sub-unit 2.16: Male reproductive system	**Hrs. theory 4 Hrs. tutorial 1**
Objectives:	Content:
1. Describe the structure of the male reproductive organs.	1. Structure and function of the external organs: penis, testes, scrotum.

2. State the general functions of the male reproductive system. 3. Name the parts of the male reproductive system and describe the general functions of each. 4. Describe the process of spermatogensesis. 5. Describe the path of sperm sells from their origin to their exit from the body 6. Describe the structure of penis and explain the mechanism of erection and ejaculation. 7. Explain how hormones control the activities of the m male reproductive organs and the development of male secondary sexual characteristics. 8. Describe how a vasectomy is performed, and discuss the relative simplicity of this procedure.	2. Formation and release of sperm cells. 3. Actions of male sex hormones. 4. Terms related to male reproductive system: • glans penis • prepuce • corpora cavernosa • corpus cavernosa • spermatogenesis • semen • inguinal • gonadotropin • testosterone • Male contraceptive devices.
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 2: Systems of the Body	**Hrs. theory** **Hrs. Practical**
Sub-unit 2.17: Female reproductive system	**Hrs. theory 4** **Hrs. tutorial 1**
Objectives:	Content:
1. Name the parts of the female reproductive system and describe the general functions of each. 2. Describe the process of oogenesis. 3. Describe how the hormones control the activities of the female reproductive system and the development of female secondary sexual characteristics. 4. Describe the process of the menstrual cycle. 5. Describe the hormonal changes that occur in the maternal body during pregnancy. 6. Describe the birth process and explain the role of hormones in this process. 7. Explain why females are more easily infected by sexually transmitted diseases than men, given equal exposure.	1. Structure and function of the vagina, clitoris, labia,ovaries, fallopian tubes, uterus, breasts and mammary glands. 2. Ova development and ovulation. 3. Hormonal control of the reproductive system. 4. Fertilization and embryonic development. 5. Pregnancy changes. 6. Process of childbirth and physiological recovery. 7. Structure and function of the mammary glands. 8. Terms related to the female reproductive system: • follicle • estrogen • progesterone • fertilization • meiosis • oogenesis • zygote • implantation • infundibulum • orgasm • ovulation • menstrual cycle • puberty and menarche • placenta • menopause • Female contraceptive devices.

Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.
Unit 3: Human Growth & Development	**Hrs. theory 5 Hrs. Practical 1**
Objectives:	Content:
1. Distinguish between growth and development. 2. Describe the formation and function of the placenta. 3. Describe the path of blood through the foetal circulatory system. 4. Describe the chief circulatory and physiological adjustments that occur in the newborn. 5. List the stages of development that occur between the neonatal period and death, and tell the general characteristics of each stage.	Foetal circulation and neonatal changes. 1. Characteristics of the stages of life development: • neonatal • infancy • childhood • adulthood • senescence 2. Causes of aging. 3. Terms related to growth and development: • amnion • chorion • zygote • embryo • foetus • placenta • umbilical cord • prenatal • neonatal • postnatal • Mid upper arm, head and chest circumference • Height and weight measurment • Body mass index
Evaluation methods: written and viva exams.	Teaching / Learning activities and resources: classroom instruction, models, charts.

1. Textbook of practical Physiology, GK PAL, PRAVATI PAL, Orient Longman.

Physics

Year: First **Credit Hours: Theory 160**
Level: Certificate **Practical: 80**
Assessment Marks: 100

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
On completion of the 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 ofthe 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.

Evaluation methods: written and viva exams, performance observation.

Teaching / Learning activities and resources: classroom instruction and demonstration, return demonstration, models, solving related problems.

Recommended Texts

1. Brij Lal and Subramanyan, Principles of Physics.
2. Nelkon and Parker, Advanced Level Physics (5th ed.)
3. Physics Practical Manual, Basanta Raj Rosyra (second edition)

Reference Texts

1. Pradhan, J.M. & Gupta, S.K., A Textbook of Physics (part I & II)
2. Verma, H.C., Concepts of Physics I & II
3. Sears, Zemansky & Young, University Physics
4. Halliday, D & Resnick, R., Physics Part I & II

Course: Physics	**Hrs. theory 160 Hrs. lab 80**
Unit 1: Mechanics	**Hrs. theory 40 Hrs. lab**
Sub-unit 1.1: Units and Measurement	**Hrs. Theory 4 Hrs. lab**
Objectives:	Content:
1. Define fundamental and derived units. 2. Explain, MKS, CGS and SI system of units. 3. Convert one system of units into another system of units. 4. Express derived units in terms of fundamental units. 5. Define precise and accurate measurement 6. Use of dimensions to derive simple physical quantities and equations (time period of simple pendulum) 7. Convert one system of units into another using dimensional formula	1. Physical concept of mass, length and time. 2. Various systems of units and their conversion. 3. Express derived units in terms of fundamental units. 4. Precise and accurate measurement 5. Dimensional formula for various physical quantities. 6. Conversion of system of units using dimensions 7. Solve simple numerical problems
Unit 1: Mechanics	
Sub-unit 1.2: Scalar and Vectors	**Hrs. theory 5 Hrs. lab**
Objectives:	Content:
1. Differentiate between scalars and vectors 2. Identify whether a physical quantity is scalar or vector. 3. Resolve vectors into two rectangular components. 4. State and explain triangle and parallelogram law of vectors 5. Point out the resultant of two or more vectors by graphical method. 6. Write the values of scalar product and vector product, for selected problems.	1. Scalar and vectors with examples. 2. Vector addition by parallelogram and triangle method. 3. Resolve a vector into two components. 4. Triangle and parallelogram law of vectors 5. The product of two vectors either results in a scalar quantity or a vector quantity. 6. Simple numerical problems
Unit 1: Mechanics	
Sub-unit 1.3: Kinematics	**Hrs. theory 5 Hrs. lab**
Objectives:	Content:
1. Define displacement, velocity, instantaneous velocity, average velocity, uniform velocity and acceleration retardation. 2. Differentiate between distance and displacement, speed and velocity. 3. Write down the relation of kinematics equation of motion (linear and gravitational). 4. Calculate the time of flight, maximum height and horizontal range of a projectile (Both cases) 5. Solve simple problems related to the projectile.	1. Displacement, velocity, instantaneous velocity, average and uniform velocity and acceleration (retardation). 2. Distance and displacement, speed and velocity. 3. The concept of projectile motion (Show that path of the projectile is parabolic) 4. Solve simple numerical problems
Evaluation methods: written and viva exams, performance observation.	Teaching / Learning activities and resources: classroom instruction and demonstration, return demonstration, models, solving related problems.
Unit 1: Mechanics	
Sub-unit 1.4: Force	**Hrs. theory 9 Hrs. lab**
Objectives:	Content:

1. State Newton's laws of motion. 2. Give the concept of inertia of rest, motion and **3.** direction. 4. Define force in terms of rate of change of momentum and give their directions. 5. Derive F = ma and used it to solve simple problems. 6. Recognize the impulse is a force act in very short interval of time. **7.** State and prove principle of conservation of linear momentum with examples. **8.** Define angular displacement, angular velocity & angular acceleration. **9.** Distinguish between angular velocity and linear velocity and derive relation between them. 10. Define circular motion, centripetal force, and centrifugal force. 11. State the magnitude and direction of centripetal and centrifugal force and their applications to centrifuge and satellite (not derivation). 12. Differentiate between elastic and inelastic collision. 13. Define friction, laws of limiting friction, angle of friction,angle of repose e of repose and coefficient of friction.	1. Linear momentum and significance of Newton's laws of motion in various concepts. 2. Interpret the meaning of inertia of rest and inertia of motion. 3. Illustrate the applications of inertia and impulse. 4. Angular displacement, velocity and acceleration 5. Derive the relation $v = \omega r$. 6. Recall vector nature of velocity and change the direction of velocity in circular motion. 7. Know the magnitude of centripetal force and 8. centrifugal force, $F = mv^2/r = mr\omega^2$ (With derivation) 9. Friction, limiting friction, angle of friction and coefficient of friction. 10. State law of limiting friction. 11. Derive the relation between angle of friction and coefficient of friction. 12. Simple numerical problems
Unit 1: Mechanics	
Sub-unit 1.5: Work, Energy and power	**Hrs. theory 4 Hrs. lab**
Objectives:	Content:
1. Define work energy and power and give their units in various systems. 2. Define KE and PE also give their magnitude. 3. State and verify the principle of conservation of energy. 4. Give examples to demonstrate the uses of the transfer of energy.	1. The distinction between the common uses of the term work, energy and power and its meaning in Physics. 2. Conservation of energy i.e. change of KE into PE giving example of falling body. 3. Give the transformation of different forms of energies i.e. PE into KE etc. 4. Simple numerical problems
Unit 1: Mechanics	
Sub-unit 1.6: Gravity and Gravitation	**Hrs. theory 5 Hrs. lab**
Objectives:	Content:
1. State Newton's law of gravitation. 2. Deduce unit and dimension of G. 3. Define acceleration due to gravity and variation of g due to height and depth 4. Differentiate between mass and weight. 5. Explain weightlessness condition in lift 6. State the condition of equilibrium of a body 7. Differentiate between center of gravity and center of mass 8. Satellite, Orbital velocity & time period	1. Laws of gravitation $F = GMm/R^2$. 2. Acceleration due to gravity, mass and weight 3. The relation between gravitation constant and acceleration due to gravity. 4. The variation of g due to height and depth. 5. Center of mass and center of gravity. 6. Conditions of equilibrium of a body with examples. 7. Simple numerical problems

Unit 1: Mechanics	
Sub-unit: 1.7 Properties of Matter	**Hrs. theory 5 Hrs. lab**
Objectives:	Content:
1. Define elasticity, stress, strain and elastic limit on the basis of Hook's law 2. Write relation for energy stored in a stretched wire and energy density 3. Define surface tension. 4. Differentiate adhesive and cohesive force. 5. Define viscosity of liquid. 6. Describe how the height of liquid rises in a capillary tube of sufficient and insufficient length.	1. Hook's law and the relation between stress, strain and elasticity of solid material 2. Elastic potential energy and energy density in a stretched wire(without derivation) 3. The property of surface tension of liquid. 4. Adhesive and cohesive forces. 5. The capillary action. 6. Viscosity and fluid movement 7. Simple numerical problems
Unit 1: Mechanics	
Sub-unit 1.8: Hydrostatics	**Hrs. theory 3 Hrs. lab**
Objectives:	Content:
1. Demonstrate that fluid pressure acts in all directions 2. Explain that liquid pressure is proportional to the depth of the liquid and independent of the shape of the vessel. 3. Define density, relative density and specific gravity of solids and liquids. 4. Upthrut, Archimedes's principle. 5. Apply Archimedes's principle to determine the specific gravity of various solids and liquids. 6. State the principle of flotation & condition of equilibrium of floating bodies. 7. Explain how barometers works 8. Describe how atmospheric pressure affects human body functions.	1. Fluid pressure and determination of the formula $P = \rho gh$. 2. Pascal's law. 3. Density, relative density and specific gravity. 4. Difference between density and specific gravity. 5. Archimedes's principle and its uses. 6. Design equipment to verify Archimedes's principle. 7. The principle of floatation and condition of equilibrium for floating bodies. 8. Atmospheric pressure with examples. 9. Introduction of Mercury barometer 10. The effect of air pressure on human body. 11. Simple numerical problems
Unit 2: Heat	**Hrs. theory 22 Hrs. lab**
Sub-unit 2.1: Thermometry	**Hrs. theory 2 Hrs. lab**
Objectives:	Content:
1. Define heat and temperature. 2. Distinguish between heat and temperature. 3. Explain sensitivity of liquid thermometers 4. Explain the operation and use of a thermometer. 5. Determine the lower and upper fixed points of the thermometer. 6. Define different temperature scales (Celsius, Fahrenheit and Kelvin) 7. Convert one temperature scale into another. 8. Use the temperature conversion formula to convert and solve numerical problems related to it	1. Concept of heat temperature. 2. Factors on which sensitivity depends 3. Demonstrate various types of thermometers and explain their uses. 4. Derivation of the formula $C/5 = [F - 32]/9 = [K - 273]$ 5. Relation between different temperature scales. 6. Simple numerical problems
Unit 2: Heat	
Sub-unit 2.2: Expansion	**Hrs. theory 6 Hrs. lab**

Objectives:	Content:
1. Describe linear, superficial and cubical expansion of solids and their expansivity. 2. Derive the relation between linear, superficial and cubical expansivity of solids 3. Define real and apparent expansion of liquid. 4. Explain the change in density of a substance with the variation temperature. 5. Discuss the density variation of water with temperature (anomalous properties of water). 6. Discuss the concept of water therapy due to high specific heat capacity of water.	1. Linear, superficial and cubical expansion of solids. 2. The relations $l_2 = l_1[1 + \alpha (\theta_2 - \theta_1)]$, $A_2 = A_1[1 + \beta(\theta_2 - \theta_1)]$, $V_2 = V_1[1 + \gamma(\theta_2 - \theta_1)]$ 3. Derivation of $\gamma = 3\alpha$ and $\beta = 2\alpha$. 4. Apparent and real expansion of a liquid and its relation 5. Change in density of an object due to change in temperature. 6. Anomalous expansion of water and its importance to marine life. 7. Why water is used for cooling and heating purposes.
Unit 2: Heat	
Sub-unit 2.3: Calorimetry	**Hrs. theory 6 Hrs. lab**
Objectives:	Content:
1. Define heat capacity, specific heat capacity. 2. Distinguish between joule and calorie as heat unit. 3. Understand the quantity of heat content of a body $Q = ms\theta$. 4. Explain the energy required to cause a phase change at constant temperature. 5. Define freezing, melting and boiling point of a substance 6. Explain latent heat of fusion and latent heat of vaporisation. 7. Discuss the effect of pressure on melting and boiling point of the substance.	1. Heat capacity, specific heat capacity. 2. Give the relation between joule and calorie. 3. Melting point, boiling point and freezing point of a substance. 4. The effect of pressure on melting and boiling point of substance 5. Determination of latent heat of fusion of ice and latent heat of steam by the method of mixture. 6. Simple numerical problems
Unit 2: Heat	
Sub-unit 2.4: Hygrometry	**Hrs. theory 3 Hrs. lab**
Objectives:	Content:
1. Define saturated and unsaturated vapours. 2. Differentiate between SVP and USVP. 3. Draw P-V and P-T diagrams and explain the behaviours of vapours. 4. Discuss the effect of pressure and altitude on the boiling point of a liquid. 5. Explain the term due point, absolute humidity and relative humidity. 6. Demonstrate the wet and dry bulb hygrometer and describe its use to determine the relative humidity	1. Learner will become knowledgeable about: 2. Saturated and unsaturated vapours. 3. Saturated VP and unsaturated VP. 4. P-V and P-T diagrams and explain the behaviours of vapours. 5. The effect of pressure and altitude on the boiling point of a liquid. 6. $R_H = \frac{\text{Partial vapour pressure of water}}{\text{vapour pressure of water}} \times 100$ % 7. Wet and dry bulb hygrometer and relative humidity.
Unit 2: Heat	
Sub-unit 2.5: Transfer of heat	**Hrs. theory 5 Hrs. lab**
Objectives:	Content:

1. Differentiate between conduction, convection and radiation. 2. Define thermal conductivity with its unit and dimension. 3. Distinguish between good and bad conductors of heat. 4. Define black body and black body radiation. 5. Explain transmission of heat by conduction, convection and radiation with appropriate application to medical field and daily use. 6. Define black body. 7. State and explain Stefan Boltzmann`s law and give an example of its application. 8. Describe medical uses of thermal radiation.	1. The transfer of heat by conduction, convection and radiation. 2. Thermal conductivity giving their dimension and units. 3. Laws of black body radiation. 4. Medical uses of heat radiation(thermal therapy) 5. Solve simple numerical problems
Unit 3: Light	**Hrs. theory 18 Hrs. lab**
Sub-unit 3.1: Reflection of light	**Hrs. theory 6 Hrs. lab**
Objectives:	Content:
1. Explain the laws of reflection of light. 2. Find the deviation of light by plane mirror as rotating mirror. 3. Distinguish between real and virtual image. 4. Show that in plane mirror object distance = image distance. 5. Define the terms pole, center of curvature, radius of curvature, principal focus, principal axis, focal length. 6. Show that r = 2f for spherical mirrors. 7. Draw ray diagrams to solve problems involving spherical mirrors. 8. Derive the formula $\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$	1. The phenomenon of reflection and hence state thelaws of reflection of light. 2. Principles of reflection of light – 3. The rotation of mirror through angle θ the reflected ray is rotated through 2θ. 4. Object distance is just equal to image distance i.e. u = v but the image is virtual. 5. Real and virtual image. 6. Image formation of spherical mirror. 7. How to correct sign for the focal length, object distance and image distance. 8. The relation, r = 2f, $\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$ and I/O = v/u = m for mirrors. 9. Nature, size and position of the image formed by spherical mirrors at various positions of the object distance on the principal axis. 10. Simple numerical problems
Unit 3: Light	
Sub-unit 3.2: Refraction	**Hrs. theory 7 Hrs. lab**
Objectives:	Content:
1. State and explain the laws of refraction of light. **2.** Verify the laws of refraction of light and define refractive index in different media. **3.** Derive the expression for apparent depth and lateral shift in a glass slab.	1. Phenomenon of refraction. 2. Refractive index in terms of the speed of light in vacuum to the speed of light in medium. 3. The relations ${}_a\mu^g \times {}_g\mu^w \times {}_w\mu^a = 1$. 4. Refractive index in terms of real depth and apparent depth.

4. Define critical angle and total internal reflection. **5.** Explain the phenomenon of total internal reflection. **6.** Explain the passage of light rays through a prism. **7.** Derive the formula $i + e = A + \delta$ and $(A = r_1 + r_2)$ 8. Define minimum deviation and derive the formula $\mu = \sin[(A + \delta_m)/2]/\sin(A/2)$ 9. Define the terms convex lens, image in lens, optical center, and thin lens. 10. Draw a ray diagram to locate positions of image in thin lenses (concave and convex). 11. Derive lens formula and lens maker's formula.	5. The relation $d = t(1 - 1/\mu)$ andlateralshift $p = t[\sin(i - r)]/\cos(r)$. 6. Derivation of the formula $\mu = 1/\sin(C)$ 7. Critical angle and conditions for total internal reflection. 8. Examples of total internal phenomenon, mirage, light pipe. 9. Ray box to demonstrate the deviation of light ray in prism. 10. The formula $A + \delta = i + e$ and $\mu = \sin[(A + \delta_m)/2]/\sin(A/2)$ 11. Uses of different types of lenses. 12. Converging aspect of convex lens and diverging aspect of concave lens. 13. Ray box to demonstrate image formation by convex as well as concave lens. 14. Lens formula and lens maker's formula. 15. Simple numerical problems
Unit 3: Light	
Sub-unit 3.3: Optical Instrument	**Hrs. theory 5 Hrs. lab**
Objectives:	Content:
1. Draw a labeled diagram of human eye. 2. Explain the eye as an instrument, which forms as sharp image on the retina. 3. Explain the terms far point, near point, and least distance of distinct vision. 4. Define the terms visual angle and angular magnification. 5. Explain the technique of removing the defect of vision. 6. Trace the path of rays through simple and compound microscopes. 7. Explain how white light is a combination of seven different colours, easily decomposed into its components. 8. Understand that refractive index varies with colours. 9. Demonstrate the dispersion of light by prism.	1. Structure of human eye with diagram. 2. The "model eye". 3. Ray diagram to explain the correction of defect of vision. 4. Use of simple and compound microscopes. 5. Calculation of the magnifying power of simple and compound microscopes. 6. Dispersion of light by prism. 7. Dispersion due to variation of refractive index with colours 8. Simple numerical problems
Unit 4: Waves and Sound	**Hrs. theory 10 Hrs. lab**
Sub-unit 4.1: Waves	**Hrs. theory 5 Hrs. lab**
Objectives:	Content:
1. Define transverse, longitudinal, progressive and stationary waves with examples. 2. Define amplitude, wavelength, frequency, period andvelocity of the wave. 3. Describe how a wave carries only energy from onepoint to another and no material particle is transmittedin the wave motion. 4. Show that a wave undergoes reflection	1. Equations of progressive and stationary waves 2. Energy flow in a wave 3. Superposition of waves 4. Reflection, refraction, diffraction, and interference of waves 5. Simple numerical problems

refraction,interference and diffraction phenomena	
Unit 4: Waves and Sound	
Sub-unit 4.2: Characteristics of Sound Waves	**Hrs. theory 5 Hrs. lab**
Objectives:	Content:
1. Differentiate between noise and music. **2.** Explain the characteristic of musical sound. 3. Define the terms sonic (audible), infrasonic, ultrasonic and super sound. 4. Define beats and write down beats formula using superposition of waves. 5. Describe how intensity of sound is proportional to the square of amplitude. 6. Define intensity level, bel and decibel. 7. Explain the threshold of hearing and threshold of pain. 8. Explain ultrasonic waves and its medical uses. **9.** Explain the evidence that sound waves in air are longitudinal waves. 10. Explain how air undergoes compression and rarefaction as sound waves travels through the air. 11. V=√E/p, Vα √T, Vα √1/M	1. The characteristics of sound i.e. note, pitch, intensity, loudness and timber. 2. Qualitative relations of pitch with frequency, intensity with loudness and overtones with quality of sound. 3. Beat and beat frequency. 4. Intensity level in terms of decibel. 5. Threshold of hearing and threshold of pain. 6. Ultrasonic wave and its medical uses. 7. V=√E/p 8. Simple numerical problems
Unit 5: Electrostatics	**Hrs. theory 10 Hrs. lab**
Sub-unit 5.1: Fundamentals of electrostatics	**Hrs. theory 3 Hrs. lab**
Objectives:	Content:
1. Explain the properties of electrical charges. 2. Distinguish between conductor, insulator, and semiconductor. 3. Explain the phenomenon of charging by friction, conduction and induction. 4. Describe the surface charge density on various conductors	1. Charges and their behaviour. 2. Electrification by friction, conduction and induction on the basis of modern theory. 3. Surface charge density 4. Simple numerical problems
Evaluation methods: written and viva exams, performance observation.	Teaching / Learning activities and resources: classroom instruction and demonstration, return demonstration, models, solving related problems.
Unit 5: Electrostatics	
Sub-unit 5.2: Electrostatic Field	**Hrs. theory 7 Hrs. lab**
Objectives:	Content:
1. State and explain Coulomb's law. **2.** Explain the properties of lines of force **3.** Define electric field and electric flux. **4.** Calculate electric field intensity due several point charges. **5.** Define electric potential difference, potential energy and electron volt. **6.** Concept about the equipotential surface. 7. Concept about zero potential 8. **E=V/d, for parallel plates capacitor**	1. Coulomb's law for point charges and derivation of the expression for force. 2. Effects of permittivity on a medium between two point charges. 3. Electric field and normal electric flux. 4. Potential and potential energy(no derivation) 5. Analogy between electric potential and gravitational potential. 6. Electron volt and its use. 7. Capacitor and Capacitance and its units 8. Series and parallel combination of capacitors

9. Explain series and parallel grouping of capacitors	9. Simple numerical problems
Evaluation methods: written and viva exams, performance observation.	Teaching / Learning activities and resources: classroom instruction and demonstration, return demonstration, models, solving related problems.
Unit 6: Magnetism	**Hrs. theory 10 Hrs. lab**
Sub-unit 6.1: Fundamentals of Magnetism	**Hrs. theory 6 Hrs. lab**
Objectives:	Content:
1. Explain magnetic field strength, lines of force, magnetic field intensity, and permeability. 2. State Coulomb's law for magnetism. 3. Describe the properties of a magnet. 4. Calculate magnetic field intensity due to a bar magnet at any point on the equatorial and axial line of a bar magnet. 5. Explain Tangent law of magnetism 6. Trace the lines of force and describe their properties. 7. Define neutral point.	1. Like pole repel and unlike pole attract to each 2. other. 3. Various types of magnets and their positions of poles. 4. Coulomb's law for magnetism. 5. Magnetic field intensity due to bar magnet at (a) end on position (b) broad side on position. 6. Lines of force around a bar magnet and the neutral point. 7. Uniform and nonuniform magnetic field 8. Simple numerical problems
Unit 6: Magnetism	
Sub-unit 6.2: Terrestrial Magnetism	**Hrs. theory 4 Hrs. lab**
Objectives:	Content:
1. Describe the dip, declination, and horizontal components of earth's magnetic field. 2. Define and give the properties of dia, para and ferromagnetic materials. 3. Concept of domain theory.	1. Dip, declination, horizontal and vertical components of earth's magnetic field. 2. Properties of dia, para and ferromagnetic 3. MaterialsDomain theory 4. Simple numerical problems
Unit 7: Current Electricity	**Hrs. theory 20 Hrs. lab**
Sub-unit 7.1: Electric current	**Hrs. theory 7 Hrs. lab**
Objectives:	Content:
1. Discuss current as the rate of flow of charge. 2. State and verify Ohm's law. 3. Define resistance and resistivity. 4. List the factors that influence resistance of a conductor. 5. Distinguish between Ohmic and non-Ohmic conductors. 6. Find the equivalent resistance from the series and parallel combination of resistors. 7. Perform the conversion of galvanometer into voltmeter and ammeter.	1. Current as the rate of flow charge. 2. Potential difference. 3. Ohm's law and its verification. 4. Expression $R = R_1 + R_2 + R_3 +$ …….and 5. $1/R = 1/R_1 + 1/R_2 + 1/R_3 +$ ….. in series and parallel combination. 6. Conversion of a galvanometer into ammeter and voltmeter. 7. Ohmic and non-Ohmic conductors from I-V curve. 8. Various types of electrical circuits. 9. Simple numerical problems
Unit 7: Current Electricity	
Sub-unit 7.2: Resistance and heat	**Hrs. theory 5 Hrs. lab**
Objectives:	Content:
1. State and explain Joule's laws of heating. 2. Distinguish between potential difference and emf.	1. Joule's laws of heating and derivation of the equation: $H = i^2Rt/J$

3. Relate emf, terminal potential and internal resistance. 4. Derive the equivalent emf from series and parallel and mixed groupings of cells 5. Define Joule's conversion factor.	2. Heat production in resistance wire due to passage of current. 3. Electric power in terms of energy dissipated in a time in the resistance wire. 4. Meaning of emf and internal resistance of a cell. 5. Relation E = V + Ir. 6. Purpose of grouping of cells to find maximum current and maximum voltage. 7. Electric power, watt, kilowatt, kilowatt-hour and horsepower. 8. Meaning of Joule's conversion factor. 9. Simple numerical problems
Unit 7: Current Electricity	
Sub-unit 7.3: Chemical effect of current	**Hrs. theory 4 Hrs. lab**
Objectives:	Content:
1. Explain the term electrolysis, electrolyte, electrodes (cathode and anode) and ions. 2. Explain electrochemical equivalent of the elements. 3. Explain Faraday's laws of electrolysis and experimental verification. 4. Define Faraday's constant. 5. Explain the thermocouple principle. 6. Explain Seebeck and Peltier effect.	1. Faraday's laws of electrolysis and the method of its verification. 2. Faraday's constant and electro chemical equivalent. 3. Thermocouple, Seebeck and Peltier effect. 4. Terms, neutral point and temperature of inversion. 5. Concept about thermoelectric series.
Unit 7: Current Electricity	
Sub-unit 7.4: Alternating Current	**Hrs. theory 4 Hrs. lab**
Objectives:	Content:
1. Describe alternating current (AC) and its interpretation. 2. Relate rms and mean value of current and voltage with its peak value. 3. Appreciate that ac meters measures rms values only. 4. Explain theintroduction of a transformer and its losses. 5. Describe step up and step down transformers. 6. Define stabilized voltage. 7. State and explain Faraday's laws of electromagnetic induction.	1. AC and DC. 2. Importance of AC over DC. 3. Expressions i_{rms}, v_{rms} and i_{mean}, v_{mean} with peak value. 4. Introduction of a transformer and energy loss mechanisms in transformers. 5. Faraday's law of electromagnetic induction. 6. Simple numerical problems
Unit 8: Modern Physics	**Hrs. theory 30 Hrs. lab**
Sub-unit 8.1: Electron	**Hrs. theory 6 Hrs. lab**
Objectives:	Content:
1. Explain the particle nature of electricity. 2. Discuss the nature, production and properties of cathode rays. 3. Derive the motion of electrons in electric and magnetic fields.	1. Particle nature of electricity. 2. Production and properties of cathode rays. 3. Moving electrons in electric and magnetic fields. 4. Specific charge of an electron (introduction) 5. Simple numerical problems
Unit 8: Modern Physics	

Sub-unit 8.2: Photoelectricity	**Hrs. theory 4 Hrs. lab**
Objectives:	Content:
1. Define the terms photoelectric effect, photon, wave function, threshold frequency and stopping potential. 2. Explain photoelectric effect on the basis of the quantum theory of radiation. 3. Draw a photoelectric circuit. 4. State Einstein's photoelectric equation. 5. Give the application of photoelectric effect (photocell).	1. Photoelectric effect. 2. Quantum theory of radiation. 3. Einstein's photoelectric equation $h\nu = \phi + \frac{1}{2} mv^2$ and interpretation 4. Workings of photocells 5. Light on photographic plate and photochemical reaction 6. Simple problems using photoelectric equations.
Unit 8: Modern Physics	
Sub-unit 8.3: X-ray	**Hrs. theory 5 Hrs. lab**
Objectives:	Content:
1. Draw well labeled diagram of modern x-ray tube. 2. Explain the production mechanism of x rays(Coolidge X-ray tube) 3. Discuss the properties and uses of x-rays 4. Explain Bragg`s law	1. Production, nature and use of x-rays. 2. Property of x-rays. 3. Various uses of x-rays 4. Bragg`s law of X-ray diffraction 5. Simple numerical problems
Unit 8: Modern Physics	
Sub-unit 8.4: Radioactivity	**Hrs. theory 6 Hrs. lab**
Objectives:	Content:
1. Explain the difference between natural and artificial radioactivity. **2.** List the main properties of α, β and γ radiation. **3.** Explain why these forms of radiation have energy on the order of mega electron voltage. 4. Write down the equations for the laws of radioactivity. 5. Write down the formula that shows that the relationship n between half-life and decay are constant. **6.** Graph the decay of radioactivity with time. 7. Explain the principle involved in radio carbon dating.	1. Radioactivity. 2. Properties of α, β and γ radiations. 3. Laws of radioactive disintegration. 4. The constant relationship between half-life and decay. 5. Medical uses of radiation and artificial radioactive nuclei. 6. $N = N_0 e^{-\lambda t}$, $dN/dt = -\lambda N$ 7. Simple numerical problems.
Unit 8: Modern Physics	
Sub-unit 8.5: Properties of nucleus	**Hrs. theory 5 Hrs. lab**
Objectives:	Content:
1. Describe the constituents of a nucleus. **2.** Classify different types of nuclei. 3. Define unified atomic mass units (amu), mass defect, binding energy and binding energy per nucleons. **4.** Calculate the mass defect and binding energy of a nucleus. **5.** Calculate energy equivalence of mass in joules, eV, and MeV. 6. Explain Einstein's mass-energy relationship theory.	1. The constituents of nuclei. 2. Isotopes and mass numbers of different elements. 3. Isotope instability. 4. $E = mc^2$ (only qualitatively). 5. Fission, fusion and energy released from these nuclear reactions. 6. Radiation hazards and safety. 7. Calculate mass defect, loss of mass due to radioactive disintegration numerically. 8. Biological effect of nuclear radiations

7. Calculate energy released from the decay of radioactive isotopes. 8. Define fission and fusion and calculate the energy released. 9. Discuss health hazards and safety related to radiation. 10. Explain biological effects of nuclear radiations	9. Simple numerical problems
Unit 8: Modern Physics	
Sub-unit 8.6: Physics and Society	**Hrs. theory 4 Hrs. lab**
Objectives:	Content:
1. Describe how our environment is being destroyed due to noise pollution, air pollution water pollution, radiation pollution 2. Discuss the wide spectrum of electromagnetic radiation from radio waves to cosmic rays. 3. Discuss ozone depletion, greenhouse effect, acid rain. 4. Discuss strategies to reduce pollution at local and national levels.	1. Deteriorating conditions of the environment we live in. 2. Useful and harmful aspects of radiation. 3. Concepts about ozone depletion, greenhouse effect and acid rain. 4. Environmental protection strategies
Practicals	**Hrs. theory Hrs. lab 80**
Objectives:	Content:
1. Determine the volume of a hollow cylinder and a solid cylinder using vernier calipers. 2. Determine the volume of a steel ball and cross section of a glass rod using a micrometer screw gauge. 3. Determine thickness of glass plate using spherometer. 4. Determine the acceleration due to gravity by using simple pendulum. 5. Verify Archimedes' principle and find the specific gravity and density of solids heavier than and insoluble in water 6. Determine the specific gravity of solids dissolved in water. 7. Determine the specific gravity and density of substances lighter than and insoluble in water 8. Verify the laws of reflection of light and find the relationship between object distance and image distance. 9. Determine the refractive index of liquid/glass slab using travelling microscope. 10. Verify laws of refraction and find the refractive index. 11. Determine the upper and lower fixed points of a given thermometer and find the correct temperature of tap water. 12. Find the focal length of a convex lens by the double pin method.	1. Application of theory form preceding units. 2. Note: Should perform compulsorily minimum fifteen(15) Experiments from above list. 3. Marks distribution for final practical examination 4. (Practical Note-3, Oral-3 & Experiment -6)

13. Verify the laws of moments of forces and find the weight of a given body. 14. Determine the latent heat of fusion of ice. 15. Determine the melting point of wax by cooling curve method. 16. Determine the magnetic moment and pole-strength of a bar magnet by locating the neutral points, keeping N-pole pointing south 17. Verify Ohm's law by using an Ohm meter and volt meter. 18. Demonstrate the variation of lateral displacement with an angle of incidence in a rectangular slab. 19. Determine the refractive index of a prism using the I-D curve method. 20. Determine velocity of sound in air at NTP using resonance tube apparatus 21. Determine angle of dip in the laboratory 22. Determine frequency of AC source using sonometer	

Chemistry

Level : Certificate (Health Science) **Teaching Hours: 240 (6 hrs/week)**

Theory Hours: 160
Year First **Practical Hours: 80**
Full Mark: 100

Course Description

This course is an introductory course designed for the students specializing 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 practical part, the different experiments to be performed are listed in 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 chemistrywithin every day life and to the application of chemistry inhealthscience.

Course Objectives:

The general objectives of this course are as follows:

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

Course: Chemistry	**Hrs. theory 160 Hrs.lab 80**
Unit 1: Physical Chemistry	**Hrs.theory 67 Hrs.lab**
Sub-unit 1.1: Elements, compounds and chemical change	**Theory: 3 hours**
Course Objectives:	Contents:
• List the symbols of elements. • Identify monovalent, divalent, trivalent elements andradicals. • List the information conveyed by symbol and formula. • Identify physical and chemical change.	• Symbols for the atom, molecule, and compound radicaland variable valency. • Writing a chemical formula, molecular formula and empirical formulae. • Significance of symbol and formula

• Identify the suitable process for separatingconstituents ofa mixture: filtration, sublimation, crystallization, distillation.	• Chemicalcompound and itsdifferencesfrom mechanicalmixture. • Pure and impure substances. • The processes of separating the constituents of a mixture:
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration – Reaction of sodium on water
Sub-unit 1.2: Chemical equations	**Theory : 3 hours**
Specific Objectives:	Contents:
• Construct a graphical representation of therelationship between amount of reactant and product with time. • Demonstrate how to balance a chemical equation. • Explain any seven types of reaction with two examplesof each. • Balance the chemical equation by hit and trial and partial equation method.	• Chemical formula, Chemical equation, reactant and product. • Significance and limitations of chemical equations. • Types of chemical reactions (seven-types) withexamples. • Balancing a chemical equation by: • hit and trialmethod • partial equationmethod
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Theoreticalexplanation, Classroom instruction exercises, Demonstration – Reaction of apiece of zinc with excess acid.
Sub-unit 1.3: Periodic table	**Theory : 5 hours**
Specific Objectives:	Contents:
• Identify the location of S,P,d, and f – block elements. • Define atomic radii, electro-negativity IP, EA. • Identify alkali and alkaline earth metals, halogens,noble gases, transition metal, radioactive elements and indicate theirlocation. • Mention the success and anomalies of Mendeleev's periodic table.	• Historical development of periodic table. • Periodic classification of elements. • Location ofs,p,d andf-block elements • Mendeleev's periodic table, success and defects of Mendeleev's periodic table • Periodocity in properties by: • Atomic radii • Electronegativity • Ionisational potential • Electron affinity
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration – Reaction of a piece of zincwith excess acid. Chartdisplay: Long and short form of periodic table.
Sub-unit 1.4: States of matter - Gaseous state	**Theory : 5 hours**
Specific Objectives:	Contents:
• Compare the volume of gas at different conditions (pressure and temperature).	• Differences between solids, liquids and gases. • Kinetic theory of gases.

• Compare the rates of diffusion of different gases. • Explain the kinetic theory of gases. • Explain Dalton's law of partial pressure. • Derive Graham's law of diffusion. • State the law of stoichiometry.	• Effect of pressure and temperature on volume of gas. • Simple derivation of ideal gas equation (PV=nRT) • Dalton's law of partial pressure. • Graham's law of diffusion. • Law of stoichiometry, Avogardo's hypothesis • Simple chemical calculations
Evaluation methods:written exam, oral and written assignments, performance observation in lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration – Reaction of a piece of zincwith excess acid
Sub-unit 1.5: States of matter - Liquid state	**Theory : 4 hours**
Specific Objectives:	Contents:
• Define solution and its types,solubility and solve problems based on solubility. • Define viscosity and surface tension. • Describe Raoult's law. • List out the colligative properties of solution. •	• Solution and its types (Unsaturated, saturated and supersaturated solution). • Solubility and related numerical problems. • Viscosity and surface tension. • Raoult's law • Colligative properties of solution
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration – Compare viscosity of glyceroland kerosene.
Sub-unit 1.6: States of matter - Solid State	**Theory : 1 hour**
Specific Objectives:	Contents:
• Define amorphous and crystalline solids and giveexamples. • List the examples of crystallization, molecular crystal, covalent crystal, ionic crystal, water of crystallization	• Classification of solids. • The difference between amorphous and crystalline solids. • Molecular crystal, Covalent crystal, Ionic crystal, Water ofcrystallization
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration – $FeCl_3$ exposed to air, bluevitriol heated
Sub-unit 1.7: Atomic structure	**Theory : 5 hours**
Specific Objectives:	Contents:
• Define electron, proton & neutron with their chargeand mass. • List the postulates of Bohr's atomic model. • Explain the Bohr's model of hydrogen atom. • Explain Rutherford's nuclear model of atom.	• Fndamentalparticles of atoms. • Bohr'spostulates of atomic model, Bohr's explanation of hydrogen spectrum. • Rutherford's nuclear model of atom. • Afbau'sprinciple, Hund's rule. • Atomic number, mass number, atomic weight and gramatomic weight, Isotopes andisobars.

• Define Afbau's principle, Hund's rule, atomic number, mass number, atomic weight, isotopes and isobars.	
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration.
Sub-unit 1.8: Electronic theory of valency	**Theory : 3 hours**
Specific Objectives:	Contents:
• Define electronic theory of valency. • List the properties of electrovalent, covalent and co-ordinate covalent compounds. • Mention the factors affecting the formation of ionic and covalent bond and also hydrogen bond.	• Electronic theory of valency • Types of chemical bond • Electrovalent • Covalent • Co-ordinate covalent • Factors affecting the formation of ionic and covalent bond; Hydrogen bond.
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration
Sub-unit 1.9: Oxidation and Reduction	**Theory : 5 hours**
Specific Objectives:	Contents:
• Describe oxidation and reduction with example. • To balance the chemical equation by oxidation number method and ion-electron method.	• Classical concept of oxidation and reduction. • Electronic concept of oxidation and reduction. • Oxidant andreductant and oxidation number • Examples of redox reaction. • Balancing the chemical equation by oxidation number method and ion electron method.
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration .
Sub-unit 1.10: Electro chemistry	**Theory : 5 hours**
Specific Objectives:	Contents:
• Differentiate between • Electrolytes and non-electrolytes • Strong electrolytes and weak electrolytes. • Ions and atoms. • Describe the variation of degree of ionization • State briefly Faradays' laws of electrolysis. • Compare the PHof neutral water above andbelow 250C. • Define buffer solution (acidic and basic) • Solve numerical problems related with PHofacidic or basic solutions.	• Electrolytes, Non-electrolytes, strong and weakelectrolytes. • Arrhenius theory of ionization. • Faradays' laws of electrolysis. • Electrolysis of water, Ionic productof water, PH, POH, Buffersolution • Importance ofPHand buffer in human body. • Simple numerical problems. •
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration

Sub-unit 1.11: Acid, base and salt	**Theory : 2 hours**
Specific Objectives:	Contents:
• Compare general properties of acid, base and salts. • Define weak and strong acid and base. • Elucidate the Arrhenious and Bronsted-Lowry concept of acids and bases. • List the different types of salts. • Identify the nature of salt solution. • Identify the requirements for the substance to beantacid and antabase.	• Characteristics of acids, bases and salts. • Arrhenious and Bronsted-Lowry concept of acids and bases. • Salts and their types. • Antacids and antabases and their medical uses.
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration – Reaction between: carbonate andacid, acid and base
Sub-unit 1.12: Solutions- True solution	**Theory : 2 hours**
Specific Objectives:	Contents:
• Define solution, solubility, solubility product and Henry's law. • Define osmosis, reverse osmosis, osmotic pressure,isotonic, hypotonic and hypertonic solutions. • Discuss the importance of osmosis phenomenon.	• Types of solution, Solubility, Solubility product, Solubility curve, Henry's law. • Osmosis,osmotic pressure,isotonic,hypotonic and hypertonic solution. • Biological importance of osmosis.
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration – Add crystals of $KMnO_4$in water and observe
Sub-unit 1.13: Solution – Colloids	**Theory : 3 hours**
Specific Objectives:	Contents:
• Identify the particle size in true solution, colloidaland suspension. • Compare the lyophilic and lyophobic solutions Withregard to the following characteristics: • electrical charge, solution, viscosity, precipitation, Tyndal effect, Brownian movement. • List examples of different types of colloidal systems.	• Comparison between true solution, colloidal solutionand suspension. • Difference between lyophilic and lyophobic solutions. • Coagulation of solutions by – • boiling, electrophoresis, addition of electrolyte. • Dialysis, and associated colloids. • Application of colloids in the medical field and ineveryday life- • precipitation of smoke, kidney dialysis machines. • Emulsions, gels and gelation.
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration

Sub-unit 1.14: Mole concept and chemical arithmetic	**Theory : 4 hours**
Specific Objectives:	Contents:
• Define mole concept in terms of mass, volume and ion. • Relate no of mole with gram molecular weight, number ofparticles and volume occupied (for gas). • Identify limiting and excess reagent. • Estimate the amount of reactant required and productformed in any reaction.	• Mole concept, Mole in the term of mass, volume and ion • Relationshipsbased upon chemical equation- - Mass – Mass relationship - Mass – volume relationship - Volume – volume relationship • Limitingreagent. • Calculation of related numerical problems.
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration
Sub-unit 1.15: Volumetric analysis	**Theory : 5 hours**
Specific Objectives:	Contents:
• Define different units of concentration and show their relation. • Prepare standard solution of desired concentration andsolve problems on dilution. • Solvedifferent numericals regarding acidimetry and alkalimetry. • Explain H2 displacement and oxide formation for determining equivalent weight. • Find the pH change in acid base titration and choice of indicator.	• Types of chemical analysis. • Equivalent and gram equivalent weight of Element, acid, base, and salt; Determination of equivalent weight by hydrogen displacement method. • Titration, acidimetry, alkalimetry, end point,indicator, primaryand secondary standard substance • Ways of expressing concentration of solution in terms of • Normality, Molarity, molality %by mass, % byvolume, parts permillion (PPm), Normality factor • pH change in acid base titration and choice of indicator. • Calculations to prepare different concentrations ofsolution.
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration
Sub-unit 1.16: Chemical kinetics	**Theory : 7 hours**
Specific Objectives:	Contents:
• Define and find the differences between molecularity and order of reaction. • Define reversible and irreversible reaction. • State and explain the Le-Chatelier's principle and its application. • State the law of mass action. • Explain the effect of pressure, temperature andcatalyst on the equilibrium state.	• Molecularity of reaction, Difference between order of reaction and molecularity of reaction. • Reversible and irreversible reaction. • Variation of reactant, product and rate of reactionwith progress of reaction (graphical representation) • Law of massaction • Le Chateliers' principle andits application

• Explain the catalyst and temperaturefasten thereaction rate. • Effect ofincreasing concentration in the case of zero, first and second .	• Activation energy and activated complex. • Zero, first and second order reactions • Catalysis:Enzyme catalysis, characteristics of enzyme catalysis, promoter, autocatalysis, negative catalysis, catalytic poisoning
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoretical explanation,problem solving, demonstration
Sub-unit 1.17: Chemical thermochemistry	**Theory: 5 hours**
Specific Objectives:	Contents:
• Match the systems, surroundings and boundaries with ourbody. • Identify whether heat is evolved or absorbed when saltis added to water. • Identify that energy is evolved in any combustionprocess. • Explain first law of thermodynamics. • Elaborate Hess's law of heat summation.	• Introduction • Enthalpy and enthalpy change, exothermic and endothermic reactions, heat of combustion and its application, heat of formation, heat of neutralization and heat of solution, bond energy. • First law of thermodynamics • Hess'slaw
Evaluationmethods: written exam, oral and written assignments, performance observationin lab	Teaching /Learning activities and resources: classroom instruction, theoreticalexplanation, problem solving, demonstration
Unit 2: Organic Chemistry	**Hrs. theory 52 Hrs. lab**
Sub-unit 2.1: An introduction to organic chemistry	**Theory : 2 hours**
Specific Objectives:	Contents:
• List the difference between organic and inorganiccompounds. • List the importance of organic compounds in medicinesand drugs with common examples.	• Introduction • Organic chemistry as a separate branch, Reason for large number of organic compounds. • Difference between organic and inorganic compounds. • Sources of organic compound • Importance of organicchemistryin medicalfield • Structure and uses of simple drugs: • Antipyretics, antiseptics,analgesics,antibiotic, antimalarials, tranquilizers, germicides, and fungicides.
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-Unit 2.2: Nomenclature of organic compounds	**Theory : 4 hours**
Specific Objectives:	Contents:
• Write the reasonsfor large number of organic compounds.	• Functional group and Homologous series • IUPAC rule, IUPAC system of aliphatic compounds.

• Classify the organic compounds into various types. • Describe functional group and homologous serieswith different examples. • Applythe IUPACsystem for nomenclature.	• Nomenclature of compounds containing functional and polyfunctional groups.
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.3: Isomerism	**Theory : 2 hours**
Specific Objectives:	Contents:
• Definethedifferent kinds of isomers. • Explain chiral carbon, optically active substance. • Define dextro – rotatory and laevo – rotatory with example.	• Definition of isomerism. • Structural isomerism of the types-postitional,functional, and chain metamerism and tautomerism with example.
Evaluationmethods: written tests, written assignments, performance observation	Teaching / Learningactivities and resources: classroom instruction, problem solving exercises,demonstrations
Sub Unit 2.4: Organic reaction	**Theory : 4 hours**
Specific Objectives:	Contents:
• Identify the nature of reaction. • Create concept about writing mechanism of simplereactions. • Draw the resonance structure with examples. • Show the significance of VSEPR theory. • Explain the types of hybridization.	• Carbocation and carbanion. • Inductive effect (+Iand –Ieffect), Significance of inductive effect • HomolyticandHeterolyticbond fission • Electrophiles and Nucleophiles. • Resonance, VSEPR theory • The types of organic reactions – Electrophilic and nucleophilic substitution, addition, elimination; Types of hybridization (sp, sp2 and sp3)
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.5: Hydrocarbons	**Hrs.theory 6 Hrs. lab**
Lesson B. alkene	Theory : 3 hours
Specific Objectives:	Contents:
• Introduce alkene • Describe thelaboratory preparation of ethene. • Write down the physical, chemical properties and uses of alkenes. • Describe the test of alkene. • Explain Markonikov's rule and anti-Markovnikov’s rule.	• Introduction • Laboratory preparation of ethene fron ethanol. • Physical and chemical properties and uses of alkenes. • Markovnikov's rule and anti-Markovnikov’s rule.

Evaluation methods:written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Lesson : C. alkyne	Theory : 3 hours
Specific Objectives:	Contents:
• Describe thelaboratory preparation of ethyne. • Explain thechemical properties of alkynes.	• Introduction • Laboratory preparation of ethyne from calcium carbide. • Chemical properties –Combustion, hydrogenation,catalytic hydration, withBr2solution,with Na, polymerization • Uses of ehtyne
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.6: Alkyl halides	**Hrs.theory Hrs. lab**
Lesson:A. chloroform	Theory : 3 hour
Specific Objectives:	Contents:
• Describe the laboratory preparation of chloroform. • List the physical and chemical properties of chloroform. • List the uses of chloroform.	• Laboratory preparation of chloroform. • Physicaland chemical properties and uses of chloroform.
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.7: Alcohol	**Theory : 4 hours**
Specific Objectives:	Contents:
• Classify alcohols. • Explain the process of fermentation. • Write the physical and chemical properties of ethanol.	• Introduction • Classificationof alcohol as-monohydric, dihydric, polyhydric, primary, secondary and tertiary. • Identificationof primary, secondary and tertiaryalcohol byoxidation method. • Preparation of ethyl alcohol from molasses by fermentation. • Physical and chemical properties of ethanol (oxidation with sodium, bleaching powder,oxygen, sulphuric acid, CH3COOH, phosphorus halide)
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.8: Carbonyl compound	**Hrs.theory 5 Hrs.lab**
Lesson:A.Aldehyde and Ketone	Theory : 5 hours

Specific Objectives:	Contents:
• Mention the general method of preparation of aldehyde. • Describe the physical and chemical properties of aldehyde. • List uses of formaldehyde.	• General methods of preparation of aldehydes and ketone: • Physical and chemical properties (NH2OH, NH2CONH2, C6H5NHNH2, NH2NH2, NaHSO3; • 2,4-DNP, Formaline, Oxidation of ammonia) • Uses
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.9: Carboxylic Acid	**Theory : 2 hours**
Specific Objectives:	Contents:
• Describe the preparation of carboxylic acid from alcohol, aldehyde and alkyl benzene. • Describe the physical and chemicalproperties ofcarboxylic acids (solubility, acidic character). • Describe the uses ofcarboxylic acid.	• Preparation of carboxylic acidfromalcohol, aldehyde and alkyl benzene. • Physicaland Chemicalproperties (acidic character, NaHSOCl2, NH3,C2H5OH, P2O5) • Uses
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.10: Ether	**Theory : 2 hours**
Specific Objectives:	Contents:
• Explain thepreparationof etherwith their common and IUPAC name. • Describe the physical and chemical properties. • Write down the uses of ether in medicine and everyday life.	• Laboratory preparationfrom ethanol. • Physical properties. • Chemical properties with- • Combustion,hydrolysis, reaction exess HI and PCl5. • Uses in medicine
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.11: Aromatic compounds	**Hrs.theory 6 Hrs.lab**
Lesson: A.Introduction	Theory : 4 hours
Specific Objectives:	Contents:
• Define aromatic compound and list the characteristics. • Identify the name of aromatic compounds and someheterocyclic compounds. • Describe the preparation of benzene and its properties.	• Introduction • Aromatic compound. • Explain benzene nucleus and side chain. • Characteristics of aromatic compound. • Preparation of benzene, physical and chemical properties (halogenation, nitration, sulfonation, Freidel Craft's reaction) • Uses

Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.11: Aromatic compounds	
Lesson:B. Nitrobenzene	Theory : 2 hours
Specific Objectives:	Contents:
• Drawthe formulaeof aliphatic and aromatic nitrocompounds. • Describe the preparation, properties and uses ofnitrobenzene. • Mention the uses of nitrobenzene.	• Introduction • Laboratory preparationof nitrobenzene. • Physical properties • ReductionreactionofNitrobenzene in different medium. • Uses in everyday life.
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.11: Aromatic compounds	
Lesson: C. Aniline	Theory : 3 hours
Specific Objectives:	Contents:
• List the preparation, properties and uses of aniline.	• Introduction • Laboratory preparation of pure aniline • Physicaland Chemicalproperties- basic nature, alkylation, acylation, sulfonation, halogenation, nitration • Uses
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.11: Aromatic compounds	
Lesson: D. Phenol	Theory : 2 hours
Specific Objectives:	Contents:
• Describe the preparation of phenol . • Identify the mono and dihydric phenols. • Explain preparation, properties and uses of phenol. • Write down the Kolbe's reaction and condensation with formaldehyde.	• Introduction • Preparation of phenol. • Physicaland Chemical properties (action with zinc dust, NaOH, NH3, PCl5, Kolbe's reaction, Condensation with formaldehyde)
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.11: Aromatic compounds	
Lesson:E. Benzoic acid	Theory : 2 hours

Specific Objectives:	Contents:
• Describe the laboratory preparation of benzoic acid. • Write down the physical, chemical properties and uses of benzoic acid.	• Laboratory preparation of benzoic acid • Physicaland Chemical properties (action with alcohol, PCl5, NH3 and soda-lime) • Uses
Evaluation methods:written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 2.12: Molecules of life	**Hrs.theory Hrs. lab**
Lesson:Carbohydrate, Proteins and enzymes, Vitamins and coenzymes and Lipids	Theory : 5 hours
Specific Objectives:	Contents:
• Explain the natural sources of Carbohydrate, Proteinsand enzymes, Vitamins and coenzymes and Lipids and their chemicalcomposition. • List the functions and uses of Carbohydrate, Proteinsand enzymes, Vitamins and coenzymes and Lipids.	**Carbohydrate:** • Definitionand classification, • Structure (Linear Cyclic) of glucose, • Functions of Carbohydrates **Protein:** • Amino acidand Peptide bond • Essential andnon-essential amino acid • Denaturationprotein • Functions ofProtein • Enzymes (Definition and importance) **Lipid:** • Introductionof lipid, fat and oil and their natural sources. • Hydrolysis • Functions offat and oil **Vitamins andcoenzymes:** • Introduction • Fat soluble and insoluble vitamins • Importanceand functions
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solving exercises,demonstrations
Unit 3: Environmental Chemistry	**Hrs. theory 5 Hrs. lab**
Sub-unit 3.1: Pollution	**Hrs.theory 5 Hrs.lab**
Lesson: Airand Water Pollution, Radioactive, Acid rain, Ozone layer depletion and GreenHouse Gas Effect	Theory : 5 hours
Specific Objectives:	Contents:
• Define source and adverse effects of pollutants. • Describe why is environment getting polluted. • Identify the cause of acid rain, water pollution and its effects.	• The sources and adverse effects due to the followingair pollutants- CO2, SO2, O3, H2S,CO, hydrocarbon, lead, cadmium dust,CFC, oxides ofnitrogen. • Air pollution and its effects on:

• List the causes of nuclear and pesticide pollution.	• human health,materials and climate,Greenhouse effect, Ozone layer depletion • Acid rain and its adverse effects. • Water pollution and its effects. • Nuclear and pesticide pollution.
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Unit 4: Inorganic Chemistry	**Hrs. theory 36 Hrs.lab**
Sub-unit 4.1: Hydrogen	**Theory : 3 hours**
Specific Objectives:	Contents:
• Describe the preparation, properties and uses ofhydrogen. • Define isotopes and uses of hydrogen.	• Laboratory preparation of Hydrogen • Physical properties. • Preparation of Vanaspati ghee. • Nascent hydrogen and molecular hydrogen • Reaction of nascent hydrogen with KMnO4, FeCl3, K2Cr2O7; Ortho and Para hydrogen, Isotopes • Uses of hydrogen.
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 4.2: Water	**Theory : 7 hours**
Specific Objectives:	Contents:
• Explain the cause of hardness of water. • Describe the chlorination of water. • List the advantage and disadvantage of hard water. • Explain the method of purification of drinking water. • Define degree of hardness of water. • Define heavy water. • Mention the difference between soft and hard water.	• Introduction of soft and andhard water. • The process of removal of hardness- Boiling, Clark's process, using washing soda, permutit process, soda – ash method, deionisation of water. • The advantage and disadvantage of hard water. • The meaning of drinking water. • Method of purification of drinking water by- • boiling, candle filtration, chemicaldisinfection, bleachingpowder, Cl2 solution, iodine,KMnO4, ozonisation, using potashalum. • The solvent property of water. • Difference between soft and hard water.
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 4.3: Carbon andits oxides.	**Hrs.theory 2 Hrs.lab**
Lesson: A.carbon monoxide	Theory : 2 hours
Specific Objectives:	Contents:
• Define allotropes of carbon. • Describe the laboratory preparation of carbon monoxide	• Introduction • Allotropes ofcarbon • Laboratory preparation of carbon monoxide

• Describe the physical and chemicalproperties of carbon monoxide.	• Physical properties of CO. • Chemical properties in reaction with - • O2, Cl2, Ni,NaOH, and haemoglobin.
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 4.4: Ammonia	**Theory : 3 hours**
Specific Objectives:	Contents:
• Explain the preparation, properties and uses of ammonia. • Write down the uses of ammonia.	• Laboratory preparation of ammonia. • Physical and chemical properties of ammonia (action with metals, Nessler's reagent, ammonia as a Lewis base, basic nature) • Uses of ammonia
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 4.5: Phosphorous	**Theory : 2 hours**
Specific Objectives:	Contents:
• Write down the toxic nature of white phosphorous. • Define phosphorescence. • Write down the uses of phosphorus.	• Introduction • Occurrence of phosphorous in animal bones, ATP and ADP. • Properties of white phosphorous –reactions • with O2, with Cl2,with caustic alkali. • Uses of phosphorous.
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 4.6: 33. Sulphur	**Theory : 5 hours**
Specific Objectives:	Contents:
• Describethepreparation, properties and usesof H2S. • Explain the preparation, properties and uses of SO2.	• Laboratory preparation of SO2 • Chemical properties of SO2 (action with lime water, sodium carbonate, oxidizing and reducing properties, bleachingproperties) • Laboratory preparation of H2S. • Reducing properties of H2S.
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 4.7: Halogens	**Theory : 5 hours**
Specific Objectives:	Contents:
• Describe the laboratory preparation of chlorine, bromine and iodine. • Define halogens.	• Laboratory preparation of Cl2,Br2 and I2 • Physical properties of Chlorine, bromine and iodine. • Compare the chemicalproperties ofhalogens-

• Compare the properties of chlorine, bromine and iodine. • Mention the uses of Cl2.	• Oxidizing action, bleachingaction, in reaction with H2, with slaked lime, and with organiccompounds. • Uses of Cl2
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-Sub 4.8: Metallic compounds	**Theory : 7 hours**
Specific Objectives:	Contents:
• Definethe terms ores, flux, slag, calcination and roasting. • Give the metallurgical process of metallurgy. • Give the preparation, properties and uses of HgCl2,Hg2Cl2,Plaster of Paris, Epsom salt, Bleaching powder,Cu2O, AgNO3, AuCl3, ZnCl2.2H2O • Mention the biological importance of Na and K.	• Difference between minerals and ores, flux and slag, calcination and roasting. • Preparation, propertiesand uses of HgCl2,Hg2Cl2,Plaster of Paris, Epsom salt, Bleaching powder,Cu2O, AgNO3, AuCl3, ZnCl2.2H2O • Biological importance of Na andK
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations
Sub-unit 4.9: Minerals	**Theory : 2 hours**
Specific Objectives:	Contents:
• Describe the sources andneedsof minerals. • Write down the biological importance and effects due to their deficiency.	• Sources of the following minerals- • Na, K, Ca, Mg, Fe, Zn, Ni, Cobalt. • Biological importance and effects due to theirdeficiency
Evaluationmethods: written tests, written assignments, performance observation	Teaching /Learning activities and resources: classroom instruction, problem solvingexercises, demonstrations

Recommended Books

Pandit, C.N. Dr.; Chemistry Education; K.P. Publication, 4433738, Dillibazar, Kathmandu.

Mitra,Ladli Mohan,A textbook of Inorganic Chemistry. Ghosh&Co.Current edition.

Tuli, G.D.et al.,Intermediate Organic Chemistry. S. Chand&Co. Currentedition.

Jauhar,S.P.,Modern ABC's of Chemistry (vol. I&II).Modern Publishers. Current edition.

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.

Pandit, C.N. Dr., Subedi, R.R. and Tiwari, Prakash; A Textbook of Chemistry; K.P. Publication, Dillibazar, Kathmandu.

Chemistry Practical

Course: Chemistry	**Hrs. theory 160 Hrs.lab 80**
Unit 1: General Chemistry - Practical	**Hrs.theory Hrs. lab 30**
Sub-unit 1.1: Introduction	**Hrs.theory Hrs. lab 8**
Specific Objectives:	Contents:
• Follow stated laboratory procedures and guidelines. • Describe safety and first aid measures for thechemistry lab. • Demonstrate the method for chemistry lab documentation.	• Procedural rules and guidelines of the chemistry lab. • Proper handling of equipment. • Lab safety measures. • Documentation procedures for laboratory work.
Evaluationmethods: written and viva exams, performance observation in laboratorysettings.	Teaching /Learning Activities / Resources: classroom instruction, text book self study,demonstration and return demonstration, laboratory practice, problemsolving
Sub-unit 1.2: Use of the Bunsen burner	**Hrs.theory Hrs. lab 6**
Specific Objectives:	Contents:
• Identify the names and functions of the parts of aBunsen burner. • Describe the correct use of the Bunsen burner and itsflame with: • air holes closed • with airholes open. • Differentiate between the uses of oxidizing andnon-oxidizing flames.	• The correct operation of the Bunsen burner. • Parts of the Bunsen burner. • Oxidizing and non-oxidizing flames.
Evaluation methods:written and viva exams, performance observation in laboratory settings.	Teaching /Learning Activities / Resources: classroom instruction, text book self study,demonstration and return demonstration, laboratory practice, problemsolving
Sub-unit 1.3: Simple lab operations	**Hrs.theory Hrs. lab 16**
Specific Objectives:	Contents:
• Separate sand and common salt in pure and dry states froma mixture of sand and common salt. Perform chloride, sulphate and nitrate test by wet way. • Separate sand and camphor from a mixture of sand andcamphor. • Recover the precipitate obtained in pure and dry statewhen the given solution-A is treated with excess of solution-B. • Solution-A = BaCl2solution • Solution-B = H2SO4solution • Prepare a sample of clearly pure distilled water fromimpure water and carry out the test for purity of water thus prepared.	• The process and methods of filtration. • Characteristics of filtrate and residue. • 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. • Properties of pure water. • Characteristics of saturated solutions. • Crystallization point and crystallization process. • Acid base reactions. • The principles and process of evaporation. • Characteristics of soluble and insoluble salts.

• Prepare a sample of bazaar copper sulphate atlaboratory temperature and use the solution to get pure crystals of salt. • Obtain sodium chloride by the neutralization of: • bench ofhydrochloric acid with a bench of sodium hydroxide. • Sodiumcarbonate with hydrochloric acid. • Prepare a soluble derivative of barium carbonate andsodium chloride.	
Evaluationmethods: written and viva exams, performance observation in laboratorysettings.	Teaching /Learning Activities / Resources: classroom instruction, text book self study,demonstration and return demonstration, laboratory practice, problemsolving
Unit 2: Inorganic Chemistry - Practical	**Hrs.theory Hrs. lab 18**
Sub-unit 2.1: Preparation of gases	**Hrs.theory Hrs. lab 8**
Specific Objectives:	Contents:
• Prepare hydrogen,nitrogen, ammonia andcarbon dioxide gases. • Identify the properties of hydrogen,nitrogen, ammonia andcarbon dioxide gases.	• 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
Evaluationmethods: written and viva exams, performance observation in laboratorysettings.	Teaching /Learning Activities / Resources: classroom instruction, text book self study,demonstration and return demonstration, laboratory practice, problemsolving
Sub-unit 2.2: Salt analysis	**Hrs.theory Hrs. lab 10**
Specific Objectives:	Contents:
• Performsaltanalysisfor basic andacidradicals by dry and wet methods.	• Proceduresfor identification of basic andacid radicals in salt. (at least 3 salts)
Evaluationmethods: written and viva exams, performance observation in laboratorysettings.	Teaching /Learning Activities / Resources: classroom instruction, text book self study,demonstration and return demonstration, laboratory practice, problemsolving
Unit 3: Physical Chemistry-Practical	**Hrs. theory Hrs.lab 16**
Sub-unit 3.1: Equivalent weights	**Hrs. theory Hrs.lab 8**
Specific Objectives:	Contents:
• Use a chemical balance to weigh various substances. • Determine the equivalent weight of a given metal by thehydrogen displacement from acid method.	• The operation of a chemical balance scale. • The meaning of equivalent weight. • Calculation of equivalent weights. • Determine the equivalent weight of metal by hydrogen displacement method.

Evaluationmethods: written and viva exams, performance observation in laboratory settings.	Teaching /Learning Activities / Resources: classroom instruction, text book self study,demonstration and return demonstration, laboratory practice, problemsolving
Sub-unit 3.2: Acidimetryand alkalimetry	**Hrs.theory Hrs. lab 8**
Specific Objectives:	Contents:
• Standardize the given acid which is approximatelydecinormal. • Determine the strength of alkalai with the help of astandard acid supplied. • Determine the strength of acid in terms of: o normality o grams/liter o percentage	• Process of titration. • Perform acid base titration. • Known and unknown solutions. • Substances with primary and secondary standards. • Preparation of solutions of various strengths. • Calculation of strengths of unknown solutions in termsof normality, molality, molarity, grams/liter, and percentage.
Evaluationmethods: written and viva exams, performance observation in laboratorysettings.	Teaching /Learning Activities / Resources: classroom instruction, text book self study,demonstration and return demonstration, laboratory practice, problemsolving
Unit 4: Organic Chemistry - Practical	**Hrs.theory Hrs. lab 16**
Sub-unit 4.1: Element detection	**Hrs.theory Hrs. lab 8**
Specific Objectives:	Contents:
• Detect the elements present in given organic compounds.	• Detection ofnitrogen, sulphur, halogens.
Evaluationmethods: written and viva exams, performance observation in laboratorysettings.	Teaching /Learning Activities / Resources: classroom instruction, text book self study,demonstration and return demonstration, laboratory practice, problemsolving
Sub-unit 4.2: Identification of organic compounds	**Hrs.theory Hrs. lab 8**
Specific Objectives:	Contents:
• Identify given organic compounds systematically.	• The identification of acetate, formate, formaldehyde,oxalate, oxalic acid, glycerol, acetone, ethyl alcohol, acetic acid, formicacid. • Selected chemical tests.
Evaluationmethods: written and viva exams, performance observation in laboratorysettings.	Teaching /Learning Activities / Resources: classroom instruction, text book self study,demonstration and return demonstration, laboratory practice, problemsolving

Reference Book for Practical

1. Khanal, Tarka; Mishra, Parmatma; Joshi, Krishna Raj; Practical Chemistry for CTEVT Level (PCL); A-Z Publication, Kathmandu.

Zoology

Level: Certificate
Year: First

Credit Hours:
Theory Hours: 120
Practical Hours: 80
Assessment Marks: 100

Course Description

This basic course in zoology discusses the characteristics of unicellular and multicellular structures. The course contains introductory zoology, cell biology, animal diversity, economic zoology, life process of mammals, evolution of organisms, relationships between organism and environment and a brief introduction about snakes found in Nepal. In order 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 kingdom (museum specimens), preparation of temporary slides, dissection of mammals so as to expose different systems and the life cycle of mosquitoes and houseflies.

Course Objectives

At the end of the course, the student will be able to:
Tell the meaning, scope and different branches of zoology.
Explain structure and functions of different kinds of tissues in a body.
Identify diversified forms of animal life.
Explain different kinds of parasites and arthropods related to human welfare.
Describe different systems of mammals.
Describe how organisms of today have been evolved from the ancestral ones.
Describe the importance and strategy of wildlife conservation.
Describe the different applications of biotechnologylogy in human health.
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 so as to expose its different systems.
Describe different stages in the life cycle of mosquitoes and houseflies.

Teaching materials required to full fill above mentioned objectives are : Board, Charts, flex prints, Over head projector, Power point projector and other teaching materials prepared by teachers.

Course: Zoology	**Hrs. theory 120 Hrs. lab 80**
Unit 1: Introduction to Zoology	**Hrs. theor 3 Hrs. lab**
Sub-unit 1.1: Definition, scope and branches of zoology	**Hrs. theory 3 Hrs. lab**
Objectives:	Content:
1. State the meaning of Zoology. 2. Describe the economic, literary and aesthetic values of Zoology.	1. Meaning of Zoology 2. Scope of Zoology 3. Different branches of Zoology related to medical science:

3. Differentiate the different branches of Zoology.	4. On the basis of structure and function - morphology, anatomy, physiology, histology, cytology. 5. On the basis of specific unit or field - toxicology, genetics, embryology, evolution, mycology, microbiology, ecology, parasitology, paleontology, taxonomy. 6. On the basis of specific group - entomology, helminthology, protozoology, bacteriology, virology.
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study.
Unit 2: Animal tissues and their types	**Hrs. theory 17**
Sub-unit 2.1: Epithelial tissue	**Hrs. theory 6**
Objectives:	Content:
1. Define a tissue. 2. Name different types of tissues (Epithelial tissues, Connective tissues, Muscular tissues, Nervous tissues). 3. Describe structure, function and location (in our body) of each of the following tissue types: 4. Simple epithelium tissue,Squamous epithelium, Cuboidal epithelium, Ciliated cuboidal, Brushbordered cuboidal Columnar epithelium, Ciliated columnar, Brushbordered columnar, Pseudostratified epithelium 5. Compound epithelium tissue :Stratified epithelium, Stratified squamous epithelium (keratinised epithelium and non-keratinised epithelium), Stratified cuboidal epithelium, 6. Stratified columnar epithelium, transitional epithelium. 7. Glandular epithelium tissue and its types.	1. Definition of tissue and its types. 2. Functions of epithelial tissues i.e. protection, secretion, excretion, absorption, exchange of materials/gases, sensory. 3. Structure, locations and functions of different types of epithelial tissues.
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study, audiovisuals showing epithelial tissues.
Unit 2: Animal tissues and their types	
Sub-unit 2.2: Connective tissues	**Hrs. theory 6**
Objectives:	Content:
1. Define connective tissue. 2. Describe briefly the characteristics, structure and functions of different types of cells forming connective tissues (Cell	1. Definition of connective tissue and its types. 2. Structural and functional study of different types of connective tissues.

types – Fibroblasts, Macrophages or Histocytes, Mast cells, Plasma cells). 3. Describe briefly the characteristics and structure of different types of cell fibres forming connective tissues (Types of fibres - Collagen or white fibres, Elastic or yellow fibres, Reticulate fibres). 4. List different types of connective tissues in our body. 5. Describe structure, function and location (in our body) of each of the following tissue types: 6. Connective tissue proper: 7. Loose connective tissue,Areolar,Adipose 8. Dense connective tissue,White fibrous tissue, 9. Tendons,Ligaments,Supportive connective tissue 10. Bone :Spongy bone,Compact bone 11. Cartilage :Hyaline cartilage,Elastic cartilage 12. Fibrous cartilage 13. Fluid connective tissue (Haemopoietic tissue): 14. Blood, Lymph 15. Identify composition of blood and blood plasma, functions of blood plasma, structure, usual number and functions of erythrocytes, leucocytes and thrombocytes. 16. Differentiate between blood plasma and serum.	3. Location of different types of connective tissues in different regions of our body. 4. Composition and functions of blood and blood plasma, etc.
Unit 2: Animal tissues and their types	
Sub-unit 2.3: Muscular tissues	**Hrs. theory 3**
Objectives:	Content:
1. Define muscular tissue. 2. Name different types of muscular tissues (striated, unstriated and cardiac). 3. Describe the basic structural characters of muscular tissues. 4. Describe location (in our body), structure and functions of striated or skeletal muscle. 5. Describe location (in our body), structure and functions of unstriated or smooth muscle. 6. Differentiate between single-unit and multi-unit smooth muscles. 7. Describe location (in our body), structure and functions of cardiac muscle.	1. Definition of muscular tissue and its types. 2. Structure and function of different types of muscular tissues. 3. Location of different types of muscular tissues in different regions of our body. 4. Differences between striated, smooth and cardiac muscles of animals.

8. Differentiate between striated, smooth and cardiac muscles of animals.	
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study, audiovisuals showing muscular tissues.
Unit 2: Animal tissues and their types	
Sub-unit 2.4: Nervous tissues	**Hrs. theory 2**
Objectives:	Content:
1. Define nerve tissue and neurons. 2. List the basic properties of neurons - excitability and conductivity. 3. Describe the structure of a neuron. 4. Differentiate between dendron and axon. 5. Describe the structures of myelinated or medullated nerve fibre and non-myelinated or non-medullated nerve fibre. 6. Define neuroglia cells and list their functions. 7. Differentiate between neuron and neuroglia cell.	1. Definition of nervous tissue and its types. 2. Structural and functional study of different types of nervous tissues.
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study, audiovisuals showing nervous tissues.
Unit 3: Diversity of Animal Life	**Hrs. theory 5**
Sub-unit 3.1: Concept of taxonomy	**Hrs. theory 2**
Objectives:	Content:
1. Define taxonomy. 2. Define species as a basic unit of classification. 3. Distinguish between artificial and natural classification. 4. Identify features studied in natural classification. 5. List modern criteria for classification of animals. 6. Define the terms used in classification.	1. Definition of taxonomy, species as a basic unit of classification, systematics, taxon, lower and higher taxa. 2. Different systems of classification 3. (Natural & Artificial). 4. Modern trends in taxonomy.
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study.
Unit 3: Diversity of Animal Life	
Sub-unit 3.2: Binomial nomenclature and classification	**Hrs. theory 3**
Objectives:	Content:
1. Define nomenclature and binomial nomenclature.	1. Binomial system of nomenclature adopted by Carolus Linnaeus (1707-1778).

2. Identify the importance of nomenclature. 3. Identify the system adopted by the International Code of Zoological Nomenclature. 4. Write scientific names of commonly found animals. 5. List common names and binomial names of those animals which are used in medical science; identify the useable body parts of each. 6. Describe each of the five kingdoms of classification with examples. 7. Identify the interrelationships among these kingdoms.	2. Selected examples of binomial nomenclature of animals. 3. Five kingdom system of classification. 4. Chief characteristics and examples of five kingdoms.
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study, visuals showing the five kingdom classification of animals.
Unit 4: Economic Zoology	**Hrs. theory 40**
Sub-unit 4.1: Hosts and parasites	**Hrs. theory 3**
Objectives:	Content:
1. Define hosts and parasites in general. 2. Define different kinds of parasites - ecto and endo-parasites, temporary and permanent parasites, facultative and obligatory parasites, occasional or accidental and wandering or aberrant parasites. 3. Define different kinds of hosts - intermediate, definitive and paratenic (transport) hosts. 4. Give examples for different kinds of hosts and parasites. 5. Name at least 20 different parasites and their usual hosts. 6. Define mutualism, commensalism and parasitism with examples of each. 7. Identify different attributes of parasites - infectivity, invasiveness, pathogenicity and toxigenicity. 8. Identify the specific and non-specific resistance factors of hosts. 9. Summarize the delicate adjustments between a host and a parasite.	1. Meaning of hosts and parasites 2. Common types of hosts and parasites with examples. 3. Types of relationships between a host and a parasite. 4. Delicate adjustments between hosts and parasites.
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study, illustrations, slides.
Unit 4: Economic Zoology	

Sub-unit 4.2: Medically important protozoans	**Hrs. theory 15**
Objectives:	Content:
1. Describe the morphology of trophozoite, pre-cystic and cystic stages of *Entamoebahistolytica*. 2. Define minuta and magna forms, convalescents and carriers. 3. List characteristics of cysts. 4. Identify the usual host and the infective stage of *Entamoeba histolytica*. 5. Describe the life history of *E. histolytica* using a labeled diagram. 6. Discuss the relationship between amoebic ulcer and amoebic dysentery. 7. Define ciliated protozoa. 8. Describe the usual habitat and morphology of *B. coli*. *9.* Describe the pathogenic significance of *B. coli.* 10. Describe control measures of *B. coli*. 11. Identify usual habitat, life history of *Plasmodium vivax* using a labeled diagram. *12.* Define nutrition in *Plasmodium.* 13. List control measures of *P. vivax.* 14. Define flagella and flagellated protozoans. 15. Describe morphology, mode of transmission, pathogenic significance and control measures of *Giardia lamblia* and *Leishmania donovani* using a labeled diagram. *16.* Differentiate between amastigote and promastigote form of *Leishmania donovani.* Describe distribution,habitat,morphology,mode of infection, pathogenic significance and preventive measures of *Trichomonas vaginalis.*	**1.** Systematic position, distribution, habitat, morphology, life cycle, mode of transmission, pathogenic effects and Preventive measures of : Entamoeba histolytica, **Plasmodium vivax, , Leishmania donovani and Blantidium coli.** 2. Systematic position, distribution, habitat, morphology, mode of transmission, pathogenecity and preventive measures of : **Entamoeba gingivalis, Giardia lamblia, Trichomonas vaginalis**
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study charts, slides, diagrams.
Unit 4: Economic Zoology	
Sub-unit 4.3: Medically important helminthes	**Hrs. theory 14**
Objectives:	Content:
1. Systematic position, distribution and habitat, life cycle, mode of transmission,	1. Distribution, habitat, morphology, life cycle, mode of transmission, pathogenic effects and

pathogenic significance and prevention of helminth parasites. 2. Describe the mechanism of development of human cystocercosis.	Preventive measures of : Taenia solium, Hymenolepis nana, Ascaris lumbricoides, Ancylostoma duodenale, Wuchereria bancrofti. *2.* Distribution, habitat, morphology, mode of transmission, pathogenecity and preventive measures of : Taenia saginata, Trichuris trichiura,Echinococcus granulosus, Enterobius vermicularis.
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study charts, slides, diagrams.
Unit 4: Economic Zoology	
Sub-unit 4.4: Medically important arthropods	**Hrs. theory 8**
Objectives:	Content:
1. Describe the distribution, habit and habitat, brief life history, and control measures of: 2. Mangemite (*Sarcoptes scabiei*) 3. Cockroaches (*Periplaneta americana*) 4. Houseflies (*Muscanebulo*) 5. Mosquitoes (*Culex*, *Anopheles* and *Aedes*) 6. Sand flies (*Phlebotomusargentipes*) 7. Human louse (*Pediculushumanus*) 8. Bed bug (*Cimex*) 9. Fleas (*Xenopsyllacheopis*) 10. List diseases caused or transmitted by each of them. 11. Distinguish between pathogenic and non-pathogenic insects. 12. Distinguish between reservoirs and vectors.	1. Introduction, Classification and public health importance of medically important arthropods. **2.** Distribution, habit and habitat, morphology, diseases and control measures of : Mangemite (*Sarcoptes scabiei*)**,**Cockroaches (*Periplaneta americana*)**,** **3.** Houseflies (*Musca nebulo*)**,** Mosquitoes (*Culex*, *Anopheles* and *Aedes*)**,**Sand flies **(***Phlebotomusargentipes*)**,**Human louse (*Pediculus humanus*)**,** Bed bug (*Cimex*)**,** Fleas (*Xenopsylla cheopis*)**.** 4. General concept of Integrated vector management approaches.
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study charts, slides, diagrams.
Unit 5: Life Process of Mammals	**Hrs. theory 34**
Sub-unit 5.1: Digestive system	**Hrs. theory 9**
Objectives:	Content:
1. Define food and nutrition. 2. List the basic kinds of nutrients - carbohydrates, proteins, lipids, vitamins, enzymes, minerals. 3. Identify the role of nutrients in the body of organisms. 4. Define digestion and digestive system. 5. List organs involved in digestive system. 6. List parts of alimentary canal.	1. Nutrition in mammals. 2. Structure and functions of parts of alimentary canal of human (Oral cavity, pharynx, esophagus, stomach, small intestine and large intestine). 3. Structure and functions of significant regions of alimentary canal and associated digestive glands. 4. Enzymatic actions of digestive glands for the digestion of carbohydrates, proteins and lipids.

7. Describe structure and functions of the parts of alimentary canal. 8. Describe structure and functions of different digestive glands. 9. Describe the mechanical and chemical digestion in different organs of alimentary canal. 10. Describe the chemistry of digestion in different organs of alimentary canal. 11. Identify the sites for the absorption of digested foods in the alimentary canal of mammals. 12. Describe the processes of absorption of food products through the absorption sites to the blood circulation.	5. Absorption sites and processes of absorption of digested food
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study charts, slides, diagrams.
Unit 5: Life Process of Mammals	
Sub-unit 5.2: Respiratory system	**Hrs. theory 4**
Objectives:	Content:
1. Define respiration and respiratory system. 2. Describe structure and functions of the respiratory organs and associated structures. 3. Describe mechanisms of: 4. External respiration (ventilation mechanisms) 5. Internal or cell respiration 6. Transport of oxygen and carbondioxide. 7. Define the terms: Tidal volume, Expiratory reserve volume, Inspiratory reserve volume, Residual volume and Total lung capacity. Bohr effect and Chloride shift.	1. Definition and types of respiration in animals. 2. Structure and functions of the respiratory organs of human. 3. Mechanisms of: 4. External respiration (ventilation mechanisms) 5. Internal or cell respiration 6. Transport of oxygen and carbondioxide. 7. Respiratory air volumes: Tidal volume, Expiratory reserve volume, Inspiratory reserve volume, Residual volume and Total lung capacity. Bohr effect and Chloride shift.
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study, charts, slides, diagrams.
Unit 5: Life Process of Mammals	
Sub-unit 5.3: Circulatory system	**Hrs. theory 7**
Objectives:	Content:
1. Define the heart of mammals. 2. Describe external and internal structures of the heart. 3. Describe the course of blood circulation in heart. 4. Identify origin of heartbeat and rate of heartbeat of mammals.	1. Definition and types of circulatios. 2. Structure (external and internal) of the heart of mammals. 3. Course of blood circulation in heart. 4. Origin, conduction and regulation of heart beat. 5. Arterial and venous blood circulation. Blood pressure. Types of blood circulations

5. Describe conduction of heart waves (impulses). 6. Identify control of heart working. 7. Define the terms such as Pacemaker, Heart sound, etc. 8. Differentiate arterial blood and venous blood. 9. Differentiate arteries and veins. 10. Define capillaries and capillary network. 11. Describe arterial blood circulation - systemic and pulmonary. 12. Describe venous blood circulation - systematic (including hepatic portal system) and pulmonary.	(Systemic, pulmonary and coronary). Hepatic portal system.
Evaluation methods: oral tests, home assignments, written examination	Course of blood circulation in heart. Origin, conduction and regulation of heart beat.
Unit 5: Life Process of Mammals	
Sub-unit 5.4: Excretory system	**Hrs. theory 4**
Objectives:	Content:
1. Define excretion and excretory system. 2. Name the types of excretory organs in mammals such as skin, lungs, liver and kidney. 3. List excretory functions of skin, lungs, liver and kidney. 4. Describe external and internal structure of a kidney. 5. Describe the structure and functions of different parts of nephron. 6. Describe the process of urine formation in mammals. 7. List composition of urine. 8. Define micturition and its causes. 9. Explain the homeostatic function of the kidney.	1. Meaning of excretion, types of excretory organs and their functions. 2. External as well as internal structure of a kidney. 3. Structure of a nephron. 4. Mechanism of urine formation (glomerular filtration, selective reabsorption, tubular secretion) and functions of different regions of a nephron. 5. Micturition and homeostasis.
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study, charts, diagrams and visuals showing internal and external structures of the kidney, uriniferous tubules.
Unit 5: Life Process of Mammals	
Sub-unit 5.5: Reproductive system	**Hrs. theory 4**
Objectives:	Content:
1. Define reproduction and its types - sexual and asexual. 2. Differentiate between sexual and asexual reproduction.	1. Definition of reproduction and its types - sexual and asexual. 2. Spermatogenesis and Oogenesis. 3. Structure and functions of male and female reproductive organs.

3. Describe structure and functions of primary sex organs or gonads (testes and ovaries). 4. Identify the secondary sex organs of males (prostrate, seminal vesicles, vas deferens and penis) and females (fallopian tubes, uterus, vagina and mammary glands). 5. Describe the structure and function of epididymus and the duct system of male. 6. Give composition of semen. 7. Give short description on spermatogenesis. 8. Describe the structure and functions of the duct system of female (fallopian tubes, uterus and vagina) carrying spermatozoa from vagina to the fallopian tube. 9. Give a short description on ovulation and menstruation.	4. Menstruation process.
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study, charts, diagrams and visuals.
Unit 5: Life Process of Mammals	
Sub-unit 5.6: Nervous system	**Hrs. theory 6**
Objectives:	Content:
1. Define nervous system. 2. Identify communication of information 3. With the outside world through eyes, ears, nose, tongue and skin. 4. Within the body through nerve impulses and chemical substances. 5. Summarize functions of nervous system. 6. Name types of nervous system - central, peripheral and autonomous. 7. Describe meninges of brain and subarachnoid space. 8. List functions of cerebrospinal fluid. 9. Differentiate grey and white matter of central nervous system. 10. Describe structure and functions of brain and spinal cord. 11. Define a nerve, nerve fibre and neuron. 12. Identify the types of nerve fibres (afferent and efferent). 13. Distinguish between sensory nerve fibre and motor nerve fibre. 14. Identify number, origin and distribution of different types of spinal and cranial nerves.	1. Definition of nervous system. 2. Structure and functions of different types of (central, peripheral and autonomous) nervous systems. 3. Transmission of nerve impulses.

15. Define reflex action with examples. 16. Describe physiological process of nerve impulse conduction. 17. Define preganglionic fibres, autonomic ganglia and postganglionic fibres. 18. Describe sympathetic and parasympathetic nervous system.	
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study, charts, diagrams and visuals.
Unit 6: Evolution	**Hrs. theory 8**
Objectives:	Content:
1. Brief description of origin of life. 2. Define evolution and organic evolution. 3. Describe historical background of organic evolution. 4. Give examples of organic evolution. 5. Distinguish between progressive and retrogressive evolution. 6. Summarize the evolution of modern man starting from human ancestors *Dryopithecus*. 7. Describe the evidence of organic evolution: morphological and anatomical, palaeontological, biochemical, genetic and embryological. 8. Describe Lamarck's theory of evolution giving examples cited by him. 9. Identify drawbacks of Lamarck's theory. 10. Describe Darwin's theory of evolution. 11. Identify drawbacks of Darwin's theory. 12. Describe mutation theory of evolution. 13. Describe modern synthesis theory of evolution.	1. Brief description about origin of life. 2. Definition and Pattern of organic evolution 3. Morphological and anatomical, palaeontological, biochemical and embryological evidences. 4. Description of : Lamarckism, Darwinism and Neo-Darwinism (modern synthetic theory of evolution) With examples. 5. Summarize the evolution of modern man starting from human ancestors *Dryopithecus*.
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study, charts, diagrams and visuals of geological time scale showing evolutionary stages.
Unit 7: Wildlife conservation	**Hrs. theory 3**
Objectives:	Content:
1. Describe wildlife. 2. Differentiate between wild life and domestic life. 3. To know the importance of wildlife conservation.	1. Definition of wildlife and conservation. 2. Importance of wildlife conservation. 3. Categories of wildlife with example. 4. Causes of extinction of wildlife. 5. Brief discussion on protected areas of Nepal.

4. Describe different categories of wildlife (Extinct, Endangered, Rare, Intermediate) with examples . 5. Identify different causes of extinction of wildlife. 6. To know about different protected areas of Nepal.	
Evaluation methods: oral tests, home assignments, written examination	Teaching / Learning activities and resources: classroom instruction, discussion, textbook /reference book self study, charts, diagrams and visuals.
Unit 8: Application of biology	**Hrs. theory 5**
Objectives:	Content:
1. To the knowledge on Vaccine in human health. 2. Describe different types of vaccines. 3. To impart the knowledge of tissue and organ transplantation. 4. To give a general concept of Amniocentesis. 5. To give a concept of test-tube baby.	1. Definition, types and application of antibiotics,vaccines in human health. 2. Definition and meaning of organ transplantation. 3. Application of organ transplantation, examples of tissue and organ transplantation. 4. Definition , brief process, advantage and disadvantage of amniocentesis. 5. Definition and brief process of formation of test-tube baby.
Unit 9: Poisonous and nonpoisonous snakes	**Hrs. theory 3**
Objectives:	Content:
1. List physical characteristics and habits of snakes. 2. Identify specific characteristics of poisonous snakes in Nepal. 3. Distinguish between poisonous and non-poisonous snakes. 4. Identify the poisonous snakes commonly found in Nepal and tell their geographical distribution. 5. Distinguish between a poisonous snakebite and a non-poisonous snakebite. 6. Identify the nature and types of snake venum according to their effects in our body.	1. Physical characteristics and habits of snakes. 2. Characteristics of poisonous snakes in Nepal. 3. Distinguish between poisonous and non-poisonous snakes.Common poisonous snakes found in Nepal and their geographical distribution. 4. Identification between a poisonous snakebite and a non-poisonous snakebite. 5. Nature and types of snake venum according to their effects in our body. 6. Snake bite, venum and its effects to our body. 7. First-aid treatment of snake bite.

Course: Practical Zoology	**Hrs. theory** **Hrs. lab 80**
Unit 1: Use of the microscope	**Hrs. theory** **Hrs. lab 2**
Objectives:	Content:
1. Name different types of microscopes and their components. 2. Handle a microscope properly. 3. Observe the given slides under the microscope in different levels of magnification. 4. Draw a labeled diagram of a microscope. 5. View given slides under the microscope. 6. Note the characteristic features of the given specimen. 7. Identify the given slide and specimen. 8. Classify the specimen and slide properly.	1. Microscope, function of its different parts and observation techniques.
Evaluation methods: practical performance tests, viva.	Teaching / Learning activities and resources: classroom instruction, demonstration, return demonstration.
Unit 2: General study of the animal kingdom	**Hrs. theory** **Hrs. lab 23**
Objectives:	Content:
1. Study given slides and specimens. 2. Draw diagrams of given specimens. 3. Write down the characteristic features of given specimens and slides. 4. Identify the main features of each slide and specimen. 5. Classify the specimens properly.	1. Different types of museum specimens: 2. Protozoa: 3. Rhizopoda : - *Entamoebahistolytica* 4. Mastigophora : - *Euglena, Giardia, Leishmania* 5. Ciliata : - *Paramecium* 6. Porifera: Sycon 7. Coelenterata: Hydra 8. Platyhelminthes: *9.* Cestodes : - *Taenia saginata, Taenia solium, Echinococcus granulosus* 10. Trematoda : - *Fasciola hepatica* 11. Nemathelminthes: *Ascaris lumbricoides, Trichuris trichiura, Enterobious vermicularis, Ancyclostoma duodenale, Wuchereria bancrofti.* 12. Annelida: Earthworm, Leech. 13. Arthropoda: 14. Crustacea: - Prawn, Crab. 15. Arachnida: - Scorpion, Spider 16. Insecta: - *Anopheles and Culex* (including life cycle), *Pediculus, Cimex* 17. Mollusca:*Unio*, *Limax* and *Pila* 18. Echinodermata: Starfish 19. Chordata: 20. Pisces: - *Scoliodon, Labeo rohita* 21. Amphibia: - Frog and Toad 22. Reptilia: - Wall lizard,*Viper*, Tortoise, *Bungarus* and *Natrix*

	23. Aves: - Crow and Pigeon. 24. Mammalia: - Bat, Ant eater and Rabbit
Evaluation methods: practical performance tests, viva.	Teaching / Learning activities and resources: classroom instruction, demonstration, return demonstration.
Unit 3: Preparation of slides	**Hrs. theory Hrs. lab 8**
Objectives:	Content:
1. Demonstrate how to tight a striated muscle specimen and stain the slide. 2. Identify the nucleus of a striated muscle cell. 3. Draw and label a diagram of striated muscle cell. 4. Prepare a temporary slide of *Pediculus*/ flea . 5. Draw labeled diagrams of preparations.	1. Preparation of temporary mounts of striated muscle, Bed bug, Flea and Louse.
Evaluation methods: practical performance tests, viva.	Teaching / Learning activities and resources: classroom instruction, demonstration, return demonstration.
Unit 4: Dissection of mammals	**Hrs. theory Hrs. lab 22**
Objectives:	Content:
1. Name the dissecting instruments and their uses. 2. Dissect selected animal specimens. 3. Dissect the systems of the animals provided. 4. Draw a labeled diagram of each system of the animals provided. 5. Examine the mammalian heart and use of a stethoscope to hear the heart beat.	1. Instruments used for dissections 2. Techniques of dissecting mammals 3. Components of systems of mammals (digestive, arterial, venous, reproductive, brain) through direct observation of the preserved body. 4. Use of stethoscope and measure of human blood pressure.
Evaluation methods: practical performance tests, viva.	Teaching / Learning activities and resources: classroom instruction, demonstration, return demonstration.
Unit 5: Life cycle of Anopheles and Culex mosquitoes and housefly.	**Hrs. theory Hrs. lab 5**
Objectives:	Content:
1. Describe the different stages of life cycle of mosquitoes and houseflies in given specimens. 2. Identify the characteristics of different stages of life cycles. 3. Draw a labeled diagram of each stage of the life cycles.	1. Stages in the life span of *Anopheles* and *Culex* mosquitoes and housefly. 2. Characteristics of the stages of each life cycles.
Evaluation methods: practical performance tests, viva.	

Unit 5: Project work	**Hrs. theory Hrs. lab 20**
Objectives:	**Content:**
1. Draw a labeled diagram of alimentary canal, kidney, brain etc. 2. Identify the characteristics of different organs of human being. 3. Know about different stages in the lifecycle of parasites. 4. Identify the animals and their characteristic features. 5. Prepare the report of field visit.	1. Demonstration of chart of different organ systems of human (Alimentary canal, Respiratory organs, Kidney, Heart and mammalian brain). 2. Demonstration the chart of lifecycle of *Plasmodium*, *Ascaris*, *Trichuris* and*Taenia*. 3. Field visit and report preparation.
Evaluation methods : practical performance tests, viva.	**Teaching/ Learning activities and resources:** classroom instruction, demonstration, return demonstration, field visit and presentation.

Recommended Texts (Latest eds.)

1. Aggarwal, S. 1998. A Textbook of Biology Part II.Vikas Publishing House Pvt. Ltd., New Delhi, India.
2. Shukla, G.S. and Upadhyay, V.B. 1993. Economic Zoology.Rastogi Publications, Meerut, India.
3. Kotpal, R.L. Modern Textbook of Zoology, Invertebrates.Rastogi Publications, Meerut, India.
4. Kotpal, R.L. Modern Textbook of Zoology, Vertebrates.Rastogi Publications, Meerut, India.
5. Chatterjee, K.D. Parasitology (Protozology and Helminthology). Medical Publishers, Calcutta, India.
6. Verma, P.S., Practical Zoology (Invertebrate)
7. Verma, P.S., Practical Zoology (Chordate)
8. Arora, D.R. and Arora B. Medical Parasitology. CBS Publisher and Distributors, New Delhi.
9. Lull, R.S. 1926. Organic Evolution. Macmillan, Newyork.

Reference Books

1. Paniker, C.K. 1993. Textbook of Medical Parasitology.Jaypee Brothers Medical Publishers (P) Ltd., New Delhi, India.
2. Wilson, Kathleen J.W. and Waugh, A. 1998.Anatomy and Physiology.Churchill Living stone, U.K.
3. Singh, Dr. V. and Jain, Dr. D.K. 1998. Nootan Biology. Nageen Publication, Meerut, India.
4. Vidyarthi, R.D. and Pandey, P.N. 1998. A Textbook of Zoology. S. Chand and Company Ltd., New Delhi, India.
5. Gupta and Malik, Practical Zoology (Invertebrate)
6. Gupta and Malik, Practical Zoology (Chordate)

Botany

Year **First** **Credit Hours: Theory: 120**
Level **Certificate** **Practical: 80**
Assessment Marks: 100

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 tells 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 the information about genetic diseases/disorders in humans. Unit six provides information about the factors of our environment, their interrelationships, and effects of pollutants to 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.

Evaluation methods: Oral and written tests, home assignments**.**

Teaching / Learning activities & resources: classroom instruction, illustrations, diagrams, visuals, textbooks, reference books.

Contents

Course: Botany	**Hrs. theory 120 Hrs. lab 80**
Unit 1: Introduction	**Hrs. theory 10**
Sub-unit 1.1: Definition, Scope and Different Branches of Botany.	**Hrs. theory 3**
Objectives:	Content:
1. Define Biology and Botany 2. Explain the scope of pbotany. 3. Explain the difference between living organisms and non-living things. 4. List the importance of plants in every day life.	1. Definition of biology and botany. 2. Objectives and scope of botany. 3. Difference between living organisms and non-living things. 4. Importance of plants.
Unit 1: Introduction	
Sub-unit 1.2: Different Branches of Botany and Their Relationships with Other Science.	**Hrs. theory 3**
Objectives:	Content:

1. List the major branches of botany and state the definition of each branch. 2. Discuss the taxonomy related to morphology, anatomy, embryology, cytology, and genetics. 3. Relate the evolution with paleontology. 4. Relate the phytogeography with ecology. 5. Correlate botany with physics/ chemistry and statistics. 6. List the branches of botany based on the organisms.	1. Different branches of botany. 2. Correlation between different branches. 3. Correlation between botany and other branches of sciences.
Unit 1: Introduction	
Sub-unit 1.3: Life Components.	**Hrs. theory 4**
Objectives:	Content:
1. Define the terms cellular pool, macromolecules and micro-molecules. 2. List the basic inorganic molecules of the living system. 3. List the basic organic molecules of living system. 4. List the function of carbohydrates, proteins, lipids and nucleic acids. 5. Differentiate the essential amino acids and nonNessential amino acids. 6. List the properties and important of water.	1. List molecules in living system. i) Water and its properties. ii) Minerals and their functions. iii) Biological Role Of Water
Unit 2: Cell Biology	**Hrs. theory 10**
Sub-unit 2.1: Introduction to Cell Biology	**Hrs. theory 6**
Objectives:	Content:
1. Explain about the discovery of cell. 2. Describe the concept of cell theory. 3. Differentiate between unicellular and multicellular organisms. 4. Draw structure of typical plant cell 5. Identify distinctions between a plant cell and an animal cell. 6. Define cell organelles and cell inclusions. 7. List different kinds of cell organelles and cell inclusions. 8. Describe the occurrence, shape and size, number and functions of different types of cell inclusions and cell organelles. 9. Cytoplasmic contents - mitochondria, endoplasmic reticulum, golgi complex, lysosome, ribosome, micro-bodies and tubules, vacuoles, cilia and flagella 10. Define plastids and mention their types and functions 11. Nucleoplasmic contents - chromatids, nucleolus, nature of nuclear membrane, etc. 12. Differentiate between cytoplasm and nucleoplasm, cristae and cisternae, lysosome	1. Discovery of cell and cell theory. 2. Plant cell and animal cell; their differences. 3. Unicellular and multicellular organisms. 4. Meaning of cell organelles and cell inclusions. 5. Structural and functional study (occurrence, shape and size, number and function) of different types of cytoplasmic and nucleoplasmic contents . 6. List the cell organelles and describe their function.

and ribosome, microtubules and microfilaments. 13. Cell wall and cell membrane	
Unit 2: Cell Biology	
Sub-unit 2.2: Cell Division	**Hrs. theory 4**
Objectives:	Content:
1. Define cell cycle, amitosis, mitosis and meiosis. 2. Describe amitosis cell division. 3. Explain the significance of amitosis. 4. Describe the steps of mitotic cell division using a labeled diagram. 5. Explain the significance of mitosis. 6. Describe the steps of meiotic cell division with necessary sketches. 7. Explain why meiosis is called reductional division and important in sexually reproducing organisms. 8. Explain the significance of meiosis. 9. Distinguish between mitosis and meiosis.	1. Definition of cell cycle. 2. Amitosis, mitosis and meiosis cell divisions. 3. Differences between mitosis and meiosis cell divisions. 4. Meiosis I and meiosis II
Unit 3: Diversity of life	**Hrs. theory 40**
Sub-unit 3.1: Classification of plant kingdom	**Hrs. theory 5**
Objectives:	Content:
1. Describe the classification system of plant kingdom into different categories. 2. Describe different taxonomic categories such as species, genus, family, order, class, division. 3. Tell about how a plant can be placed in hierarchic system in classification.	1. Classification of plant kingdom (2 Kingdom and 5 Kingdom) 2. Binomial nomenclature. 3. Taxonomic categories. 4. Hierarchic system in classification.
Unit 3: Diversity of life	
Sub-unit 3.2: General characteristics of different plant groups.	**Hrs. theory 5**
Objectives:	Content:
1. List the characteristics of algae. 2. List the characteristics of fungi. 3. List the characteristics of Bryophytes. 4. List the l differences between pteridophytes and gymnosperms based on morphology. 5. Identify the type of leaves in dicot and monocot plants. 6. Differentiate dicot root from monocot root. 7. Describe the structural differences between a monocot plant and a dicot plant.	1. The unicellular plant and multicellular plant. 2. The characteristics of algae, fungi and bryophytes. 3. Morphological characteristics of pteridophytes. 4. Morphological characteristics of gymnosperms. 5. General characteristics of angiosperms. 6. Differences between monocot and dicot plants. 7. Parts of flowering plants.
Unit 3: Diversity of life	
Sub-unit 3.3: Algae	**Hrs. theory 4 Hrs. lab 2**
Objectives:	Content:
1. Define algae. 2. Differentiate chlorophyceae, pheophyceae and rhodophyceae algae. 3. Classify Spirogyra.	1. Structure of Spirogyra. 2. Life cycle of Spirogyra. 3. Medicinal values of algae.

4. Describe about vegetative, asexual and sexual reproduction in Spirogyra. 5. Explain what conjugation is. 6. Describe the life cycle of Spirogyra using a labeled diagram. 7. Describe the medicinal values of different kinds of algal plants.	
Unit 3: Diversity of life	
Sub-unit 3.4: Fungi	**Hrs. theory 8**
Objectives:	Content:
1. Define fungi. 2. Compare fungal plant with algal plant. 3. Describe the morphology of a typical fungal plant. 4. Identify the hypha and mycelium of a fungus. 5. Describe briefly the different methods of asexual reproduction in Fungi. 6. Tell about the stages of sexual reproduction (i.e. plasmogamy, karyogamy and meiosis). 7. Distinguish between edible and poisonous mushrooms. 8. List the fungal plants, which are used in antibiotic production. 9. List the fungal plants, which cause diseases in man. 10. Define lichen, mention their types and Importance.	1. Morphology of a typical fungal plant. 2. Types of reproduction in brief of reproduction in brief: 3. Vegetative 4. Asexual 5. Sexual 6. Life cycle of *Mucor*, *Penicillium* and *Aspergillus.* 7. Differences between edible and poisonous mushroom. 8. Economic importance of fungi especially in the field of human health and medicine. 9. Define lichen, mention their types and importance.
Unit 3: Diversity of life	
Sub-unit 3.5: Monera (Bacteria & Nostoc)	**Hrs. theory 9 Hrs. lab 6**
Objectives:	Content:
1. **Bacteria -**List the characteristics of bacteria. 2. Describe the structure of bacteria. 3. Differentiate Gram positive bacteria from Gram negative bacteria. 4. Describe the types of bacteria. 5. Define toxin. 6. State Koch's postulate. 7. List the harmful and beneficial aspects and activities of bacteria. 8. **Nostoc**- Define *Nostoc*. 9. Differentiate Bacteria and Cyanobacteria. 10. Classify Nostoc. 11. Describe about vegetative and asexual reproduction in *Nostoc*. 12. Describe the importance of Nostoc in agriculture.	1. Structure and types of bacteria. 2. Differences between gram positive and gram negative bacteria. 3. Factors influencing the growth of bacteria. 4. Koch's postulate. 5. Economic importance of bacteria. 6. beneficial activities 7. harmful activities 8. Structure of Nostoc. 9. Describe about vegetative and asexual reproduction in *Nostoc*. 10. Describe the importance of Nostoc in agriculture.
Unit 3: Diversity of life	
Sub-unit 3.6: Virus	**Hrs. theory 9 Hrs. lab 2**
Objectives:	Content:
1. Define virus particles.	1. Definition of virus. 2. Characteristics of a virus.

2. Describe the nature and chemical composition of viruses. 3. Describe the structure and function of a bacteriophage. 4. Tell about mode of nutrition in viruses. 5. Mention the types of viruses on the basis of host and nucleic acid - bacterial virus. 6. Compare plant and animal viruses. 7. Differentiate DNA virus from RNA virus. 8. Tell the effect of retrovirus in man. 9. List the agents responsible for transmission of viruses. 10. Tell about the method of multiplication (Lytic and Lysognic cycle) of viruses. 11. List the economic importance of viruses in the field of human health and medicine.	3. Classification of viruses. 4. multiplication (Lytic and Lysognic cycle) of viruses 5. Transmission of viruses. 6. Economic importance of viruses.
Unit 4: Life Process (Physiology)	**Hrs. theory 20 Hrs. lab 10**
Sub-unit 4.1: Diffusion	**Hrs. theory 3 Hrs. lab 2**
Objectives:	Content:
1. Define diffusion. 2. Tell about the factors that affect diffusion. 3. List the significance of diffusion on plant life and animal body.	1. Definition and process of diffusion. 2. Factors affecting diffusion. 3. Significance of diffusion.
Unit 4: Life Process (Physiology)	
Sub-unit 4.2: Osmosis	**Hrs. theory 4**
Objectives:	Content:
1. Define osmosis (including endo-and exoosmosis), osmotic pressure and osmotic potential. 2. Tell the meaning of hypertonic and hypotonic solution, isotonic solution 3. Tell the meaning of turgid and flaccid cells. 4. Describe stomata movement. 5. Describe osmosis in living cells. 6. Factors which affect osmosis 7. List the significance of osmosis. 8. Relate the osmosis with plasmolysis.	1. Definition of osmosis. 2. Type of osmosis. 3. Demonstration of osmosis by potato-osmoscope & egg membrane. 4. Plasmolysis and deplasmolysis. 5. Factors which affect osmosis 6. Significance of osmosis.
Unit 4: Life Process (Physiology)	
Sub-unit 4.3: Transpiration	**Hrs. theory 4**
Objectives:	Content:
1. Define transpiration. 2. Describe types of transpiration. 3. Describe the mechanism of transpiration in plants. 4. Describe unequal transpiration in dicot leaf. 5. Mention the factors that affect transpiration. 6. Describe the role of stomatal transpiration. 7. List the significance of transpiration.	1. Definition of transpiration. 2. Factors affecting transpiration. 3. Types and significance of transpiration. 4. Demonstration of transpiration by: a. Beljar method 5. Cobalt chloride paper method.
Unit 4: Life Process (Physiology)	
Sub-unit 4.4: Photosynthesis	**Hrs. theory 3**

Objectives:	Content:
1. Define photosynthesis. 2. Identify the sites of photosynthesis. 3. Discuss the importance of photosynthesis. 4. Describe general layout of process of photosynthesis.	1. Definition of photosynthesis. 2. Identify the sites of photosynthesis. 3. Discuss the importance of photosynthesis. 4. Describe general layout of process of photosynthesis. 5. Experiments: 6. To demonstrate that CO_2 is necessary for photosynthesis 7. To demonstrate that O_2 is evolved during photosynthesis. 8. To demonstrate that chlorophyll is necessary for photosynthesis 9. Importance of photosynthesis.
Unit 4: Life Process (Physiology)	
Sub-unit 4.5: Respiration and Fermentation	**Hrs. theory 6**
Objectives:	Content:
1. Define respiration. 2. Explain aerobic and anaerobic respiration with examples. 3. Identify the sites of respiration. 4. Differentiate anaerobic respiration from aerobic respiration. 5. Define fermentation. 6. Name the organisms involved in alcoholic fermentation. 7. Correlate fermentation with our daily life.	1. Definition of respiration. 2. Types of respiration. 3. Experiments 4. To demonstrate aerobic respiration 5. To demonstrate anaerobic respiration. 6. Differences between anaerobic and aerobic respiration. 7. Definition of fermentation. 8. Importance of fermentation in our daily life.
Unit 5: Genetics	**Hrs. theory 11**
Sub-unit 5.1: Heredity and Variation	**Hrs. theory 2**
Objectives:	Content:
1. Define heredity and Types of variation 2. Tell about the causes of variations 3. Tell the terms: alleles, genotype, etc. 4. Differentiate clone from offspring.	1. Definition of heredity and types of variation 2. Difference between heredity and variation 3. Difference between clone and offspring
Unit 5: Genetics	
Sub-unit 5.2: Mendel's Law of Inheritance	**Hrs. theory 2**
Objectives:	Content:
1. Mention why Mendel chose pea for his experiment. 2. Tell an idea of gametogenesis on the basis of separation of allelic gene. 3. List the ratio of monohybrid cross and dihybrid cross.	1. Description of Mendel's monohybrid cross and dihybrid cross. 2. Mendel's law of inheritance
Unit 5: Genetics	
Sub-unit 5.3: Nucleic Acid and Genetic Disease	**Hrs. theory 4**
Objectives:	Content:
1. Name the compounds that build up DNA and RNA 2. Differentiate DNA and RNA.	1. Genetic diseases found in human being. 2. Difference between DNA and RNA. 3. Compounds that build up DNA and RNA

3. List the genetic diseases found in human being. 4. Chromosomal disorder (Down's Syndrome, Edward's Syndrome, Turner's Syndrome and Kleinfeilter's Syndrome) 5. Gene Disorder (Albinism, Alzheimer Disease, Daltonism, Haemophilia)	4. Chromosomal disorder (Down's Syndrome, Edward's Syndrome, Turner's Syndrome and Kleinfeilter's Syndrome) 5. Gene Disorder (Albinism, Alzheimer Disease, Daltonism, Haemophilia)
Unit 5: Genetics	
Sub-unit 5.4: Determination of Sex	**Hrs. theory 2**
Objectives:	Content:
1. Tell about autosome and sex chromosome. 2. Describe the concept of sex determination in mammals, insects, birds and reptiles. 3. Explain why the female has no responsibility in determining the sex of a child in humans. 4. Tell the concept of heterogametic male and heterogametic female.	1. Description of autosomes and sex-chromosomes 2. Types of sex-determination : o Heterogametic males o XX female - XY male o XX female - XO male o Heterogametic females o ZO female - ZZ male o ZW female - ZZ male
Unit 6: Environmental Biology	**Hrs. theory 10 Hrs. lab 6**
Sub-unit 6.1: Ecology	**Hrs. theory 4 Hrs. lab 6**
Objectives:	Content:
1. Define ecology and ecosystem. 2. List the abiotic factors of ecosystem 3. List the biotic factors of ecosystem. 4. Write structural and functional aspects of grassland and pond ecosystem 5. Mention the main source of energy in an ecosystem	1. Definition of ecology and ecosystem. 2. Structural and functional component of ecosystem grassland and pond ecosystem 3. Describe food chain, food web and ecological pyramid.
Unit 6: Environmental Biology	
Sub-unit 6.2: Pollution of Water and Air.	**Hrs. theory 3**
Objectives:	Content:
1. Define pollution. 2. List biodegradable pollutants. 3. List non- biodegradable pollutants. 4. List sources of water pollutants. 5. Identify the causes of water pollution. 6. List the preventive measures to control water pollution. 7. List the sources of air pollutants. 8. List the effect of air pollution. 9. Mention the preventive measures to control air pollution..	1. Definition of pollution and pollutants. 2. Types of pollutants. 3. Source of water pollution, their effect and preventive measures. 4. Source of air pollutants, their effect on living organisms and preventive measures of air pollution.
Unit 6: Environmental Biology	
Sub-unit 6.3: Ecological Imbalances.	**Hrs. theory 3**
Objectives:	Content:
1. Explain the theory of the "green house effect". 2. List the causes of green house effect.	1. Description on green house effect, acid rain and depletion of the ozone layer.

3. Tell the consequences of green house effect. 4. Discuss the significance of green house effect, and explain why many scientists believe it will create a global crisis. 5. Tell how acid rain is formed 6. List the harmful effects of acid rain 7. List the importance of the ozone layer for living organisms. 8. Tell how some scientists believe the ozone layer is going to deplete. 9. Describe the consequences of depletion of the ozone layer.	
Unit 7: Economic Botany	**Hrs. theory 10 Hrs. lab 4**
Sub-unit 7.1: Medicinal plants	**Hrs. theory 4 Hrs. lab 4**
Objectives:	Content:
2. List the habit and distribution of medicinal plants. 3. List the uses of medicinal plants. 4. Identify the parts of the plant which have medicinal value. 5. Name the chemical compounds from particular medicinal plants. 6. Tell what form of plant part is used for the treatment of specific cases.	1. The habit, distribution, parts used, medicinal value and uses of following medicinal plants. : ➢ *Mentha arvensis* (Pudina) ➢ *Adhatod vasica* (Asuro) ➢ *Zinger officinalis* (Aduwa) ➢ *Rauwolfia serpentina* (Sarpagandha) ➢ *Cinnamomum zylenica* (Dalchini) ➢ *Datura stromonium* (Dhaturo) ➢ *Papaver somniferum* (Opium) ➢ *Santalum album* (Shreekhanda) ➢ *Cochicum luteum* (Colchium) ➢ *Eletteris cordamonum* (Alaichi) ➢ *Mellia azedarach* (Bakenu) ➢ *Ocimum sanctum* (Tulsi) ➢ *Aloe vera* (Gheukumari) ➢ *Azadiachita indica* (Neem) ➢ Cordyceps s*inensis* (Yarsagumba) ➢ *Orchis hatagirea* (Panchanle)
Unit 7: Economic Botany	
Sub-unit 7.2: Nutritional Values of Cereal Crops, Fruits, Vegetables and Oil Yielding Plants.	**Hrs. theory 4**
Objectives:	Content:
1. Identify the nutritional value of cereal crops. 2. List the nutritional value of vegetables. 3. Tell the nutritional value of fruits. 4. Tell the nutritional value of oil yielding plants. 5. Compare the nutritional value of rice maize, white, gram and bean. 6. Compare the nutritional value of mango, grape, pear banana and orange. 7. Compare the nutritional value of potato, cauliflower, cabbage, tomato and brinjal.	1. The nutritional values of cereal crops; fruits, vegetables and oil yielding plants: 2. Cereal crops - rice, wheat, maize, gram, and bean. 3. Fruits- mango, banana, grape, pear and orange 4. Vegetables- cauliflower, cabbage, tomato potato, brainjal 5. Oil yielding plants - mustard, ground nut, caster

8. Compare the nutritional value of mustard, groundnut and caster.	
Unit 7: Economic Botany	
Sub-unit 7.3: General Concept on Ethnobotany.	**Hrs. theory 2**
Objectives:	Content:
1. Define the term 'ethnobotany'. 2. Describe the kinds of information included in traditional knowledge. 3. Discuss ways of gathering traditional knowledge. 4. Discuss the value and importance of traditional knowledge. 5. List the ways ethnobotany is useful in the field of medicine. 6. Discuss how to gather information about the use of local plants in medicine.	1. Definition of ethnobotany. 2. Importance of ethnobotany in the field of medicine. 3. A survey questionnaire for data collection, if the plant is used as medicine.
Unit 8: Biotechnology	**Hrs. theory 8**
Sub-unit 8.1: Introduction to Biotechnology	**Hrs. theory 5**
Objectives:	Content:
1. Define biotechnology. 2. List the branches of biotechnology. 3. List the scope of biotechnology. 4. Describe the application of biotechnology in medicine, agriculture and fermentation technology. 5. Concept of plant tissue culture.	1. Definition and scope of biotechnology. 2. Branches of biotechnology. 3. Application of biotechnology in: ➢ Medicine ➢ Agriculture ➢ Fermentation. 4. Bio fertilizer and organism used as bio fertilizer. 5. Plant tissue culture and its type.
Unit 8: Biotechnology	
Sub-unit 8.2: Genetic Engineering	**Hrs. theory 3**
Objectives:	Content:
1. Define genetic engineering 2. Requirement of Genetic engineering 3. Describe the applications of genetic engineering in the field of medicine. 4. Tell about the possible dangers of genetic engineering.	1. Definition of genetic engineering and recombinant DNA technology. 2. Steps of genetic engineering. 3. Application of genetic engineering. 4. Possible dangers of genetic engineering.

Botany Practical

Evaluation methods: performance observation, written exams, viva.

Teaching / Learning activities & resources: Classroom instruction, demonstration, return demonstration, slide preparation, microscopic observation

Course: Botany Practical	**Hrs. Practical : 80**
Unit 1: Introduction to the compound microscope	**Hrs. Practical 6**
Objectives:	Content:
• Define compound microscope. • Differentiate between simple and compound microscope. • Tell the names of lenses used in a 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. • Describe the way of handling a compound microscope. • Draw a well labeled diagram of a compound microscope by observation.	• A compound microscope. • Methods of handling of a compound microscope.
Unit 2: Cell biology	**Hrs. theory Hrs. lab**
Sub-unit 2.1: Temporary slide preparation of plant cells.	**Hrs. theory Hrs. lab 8**
Objectives:	Content:
1. List the apparatus required to prepare temporary slides of plant cells. 2. List the chemicals required to prepare temporary slides of plant cells. 3. List the function of safranine and glycerine. 4. Describe the method of slide preparation from the epidermal layer of onion scale, *Tradescantia* leaf, *Hydrilla* leaf, *Geranium* leaf. 5. Compare the cell structure of Onion scale, *Tradescantia* leaf, *Hydrilla* leaf, and *Geranium* leaf. 6. List the characteristics of the cellular structure of each. 7. Describe the method to peel out the epidermal layer in each case. 8. Tell why you should use glycerin instead of water when mounting a temporary slide.	1. The preparation of temporary slides of plant cells. 2. The different cellular structure of plant cells.

9. Draw diagrams of each by observing temporary slides under the microscope.	
Unit 2: Cell biology	**Hrs. theory Hrs. lab**
Sub-unit 2.2: Different stages of mitosis and meiosis divisions from permanent slides.	**Hrs. theory Hrs. lab 4**
Objectives:	Content:
1. Define mitosis and meiosis. 2. Describe different stages of mitosis like interphase, prophase metaphase, and anaphase and telophase. 3. List the nuclear changes in each stage of mitosis. 4. Tell the types of cells where mitotic cell division takes place. 5. Give the examples of mitotic cell division in plants. 6. Describe different stages of meiosis by observation of permanent slides under the compound microscope. 7. Tell the time period of meiotic cell division of the plant. 8. Name the type of cell where meiotic cell division occurs. 9. Draw figures of mitosis and meiosis by observing under the microscope.	1. The different stages of mitosis and meiosis with the help of permanent slides.
Unit 3: Biodiversity	**Hrs. theory Hrs. lab**
Sub-unit 3.1: Monera	**Hrs. theory Hrs. lab 10**
Objectives:	Content:
1. Define bacteria 2. Describe the nature of bacterial cells. 3. List the components of the bacterial cell wall. 4. list the required material and chemicals for Gram staining. 5. List the role of chemicals used in Gram staining. 6. differentiate Gram positive bacteria from Gram negative bacteria. 7. Draw diagrams of bacteria by observing under the microscope. 8. Describe the vegetative structures of *Nostoc*. 9. Explain the function of heterocyst in *Nostoc*. 10. Describe the reproductive stages of *Nostoc*. 11. Draw figures of these as observed under the microscope. 12. Give the systematic position of *Nostoc*.	1. Definition and nature of bacterial cells 2. The method of Gram staining of bacteria. 3. Classification, vegetative structure, and reproductive stages of *Nostoc*.
Unit 3: Biodiversity	**Hrs. theory Hrs. lab**
Sub-unit 3.2: Vegetative structure and reproductive stages of Spirogyra	**Hrs. theory Hrs. lab 2**
Objectives:	Content:

1. Describe the vegetative structures of Spirogyra. 2. Tell the reasons why Spirogyra is so called. 3. Describe the reproductive stages of Spirogyra. 4. Draw figures of these as observed under the microscope. 5. Give the systematic position of Spirogyra.	1. Classification, vegetative structure, and reproductive stages of Spirogyra.
Unit 3: Biodiversity	**Hrs. theory Hrs. lab**
Sub-unit 3.3: Vegetative structure and reproduction of selected fungi	**Hrs. theory Hrs. lab 8**
Objectives:	Content:
1. Define fungi. 2. Tell the meaning of mycelium, hypha, metuli, clestothecium. 3. Describe the vegetative structure and reproductive stages of: ➢ *Mucor* ➢ *Aspergillus* ➢ *Penicillium* 4. Differentiate between poisonous mushrooms and edible mushrooms. 5. Draw figures of both poisonous and nonpoisonous mushrooms by observing under the microscope.	1. The vegetative structure and reproductive stages of: ➢ *Mucor* ➢ *Aspergillus* ➢ *Penicillium* 2. The morphological features of mushrooms.
Unit 3: Biodiversity	**Hrs. theory Hrs. lab**
Sub-unit 3.4: Bryophytes, Pteridophytes, Gymnosperms and Angiosperms	**Hrs. theory Hrs. lab 14**
Objectives:	Content:
1. List the characteristics of bryophytes. 2. List the characateristcs of pteridophytes. 3. Differentiate bryophytes from pteridophytes. 4. Discuss the concepts of gametophyte and sporophyte. 5. Explain why pteridophytes are also called vascular cryptograms. 6. List the morphological features of gymnosperm and angiosperms. 7. Differentiate gymnosperms from angiosperms. 8. Differentiate dicot plants from monocot plants. 9. Describe the parts of a flower: ➢ Calyx ➢ Corolla ➢ Androecium ➢ Gynoecium 10. Draw figures of each of the plants which are observed during the lab experience.	1. The characteristics of bryophytes with reference to *Marchantia*. 2. Morphological features of gymnosperms with reference to pinus. 3. Morphological features of pteridophytes with reference to ferns (*Dryopteris*). 4. The different parts of dicot plants and monocot plants. 5. Different parts of a typical flower.
Unit 4: Plant physiology	**Hrs. theory Hrs. lab**

Sub-unit 4.1: Demonstration of physiological experiments	**Hrs. theory Hrs. lab 10**
Objectives:	Content:
1. Define diffusion, osmosis, photosynthesis, respiration and transpiration. 2. Describe the types of : ➢ Osmosis ➢ Respiration ➢ Transpiration 3. List the required material to demonstrate each experiment. 4. Tell the concept of hypotonic, hypertonic and isotonic solution. 5. Discuss the procedure to demonstrate each physiologic experiment. 6. Describe the result and conclusion of each experiment. 7. List the precautions and possible risks of each experiment. 8. Draw the necessary figures to show the demonstration of each experiment.	1. Process of diffusion by copper sulfate crystal. 2. The osmosis process by egg membrane method and by potato osmoscope. 3. Oxygen is evolved during photosynthesis. 4. Carbon dioxide is necessary for photosynthesis (Moll's experiment) 5. Carbon dioxide is evolved during aerobic respiration. 6. Chlorophyll is essential for photosynthesis. 7. Carbon dioxide gas is evolved during anaerobic respiration. 8. Transpiration by: Bell-jar method, Cobalt chloride method, and relation between transpiration and absorption.
Unit 5: Ecology	**Hrs. theory Hrs. lab**
Sub-unit 5.1: Ecosystem and Adaptation features of selected plants	**Hrs. theory Hrs. lab 6**
Objectives:	Content:
1. Discuss aquatic ecosystem 2. List the morphological features of xerophytic plants (eg. *Pinus*). 3. Describe how xerophytic plants compensate for insufficient water supply. 4. List the morphological features of hydrophytic plants (eg. *Hydrilla*). 5. Tell about the mode of water conduction by hydrophytic plants.	1. Survey and list structural component of aquatic ecosystem with reference to pond or aquarium. 2. Xerophytic and hydrophytic plants.
Unit 6: Genetics	**Hrs. theory Hrs. lab**
Sub-unit 6.1: Structure of DNA	**Hrs. theory Hrs. lab 6**
Objectives:	Content:
1. Describe the structural components of DNA. 2. List the components of a nucleotide. 3. Explain the concept of the base pairing rule. 4. Describe the purine and pyrimidine compounds of a DNA molecule. 5. List the functions of DNA. 6. Draw a figure of the Watson and Crick model of DNA by observation of a model.	1. Watson and Crick model of DNA structure.
Unit 6: Genetics	**Hrs. theory Hrs. lab**

Sub-unit 6.2: Survey of some human heredity characteristics	**Hrs. theory Hrs. lab 6**
Objectives:	Content:
1. List some hereditary characteristics of humans. 2. Describe the role of dominant or recessive genes to express certain characteristics. 3. Discuss the methods of data collection of hereditary characteristics. 4. Calculate the frequency of each hereditary characteristic in certain populations.	1. The role of dominant or recessive genes to express some hereditary characteristics of humans.

Recommended Texts

1. Singh.A.G, Karky. B, Hamal.J.P., Nag. P. **Botany** for CTEVT, Ayam Publication, Kathmandu, Nepal.
2. Singh.A.G, Karky. B, Hamal.J.P., Nag. P., Joshi. S. **Practical Botany** for CTEVT, Ayam Publication, Kathmandu, Nepal.
3. Dutta, A.C., Classbook of Botany, Oxford University Press, Calcutta.
4. Alexopolous, C.J., Introductory Mycology, John Wiley and Sons, New York.
5. Pandey, B.P., Economic Botany, S. Chand and Company Ltd., New Delhi.
6. Salisbary and Ross, Plant Physiology.
7. Medicinal plants of Nepal, HMG of Nepal.
8. Gangulee, M.C. and Kar, A.K., College Botany Vol. II New Central Book Agency, Calcutta.
9. Kochhar PL Genetics and Evolution, Ratan Prakashar Mandor, Delhi.
10. Shah and Sonhas, Cytogenics, Plant Breeding and Evolution, Vikash publishing House Pvt. Ltd. V. P.
11. Ranjtkar H.D. Laboratory Manual and Viva-voce for Proficiency Certificate Level, AK Ranjitkar, Kathmandu.
12. Pandey, B.P., Modern Practical Botany Vol. I and II, S Chand and Company Pvt. Ltd., New Delhi.

References Books:

1. Sharma, O.P. and Agrawal, V.K.S., Cell biology, Genetics, Evolution and Ecology.
2. Bhattic, K.N. and Khanna, Modern Approach to Botany, Surya Publication, Jalandhar.
3. Saxena A.L. and Sarabhai, R.P., A Textbook of Botany, Batan Prakashan Mandor.
4. Bilgrami, K.S., Shrivastava, L.M., and Shremali, J.L., Fundamentals of Botany, Vani Educational Books.
5. Dey, N.C., and Dey, T.K., Medical Bacteriology, Messers Allied Agency.
6. Sharma, D.P., Hill's Economic Botany, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.
7. Winchester, A.M., Biology and Its Relation to Mankind 3rd ed.
8. Singh,V., and Sinha, S., Cytogenetics.
9. Man Dhar, C. L., Introduction to Plant Virus, S. Chand and Company Ltd., Delhi.

Mathematics & Statistics

Year	**First**	**Total Hours:**	**200**
Level	**Certificate**	**Theory Hours:**	**160**
		Practical Hours:	**40**
		Assessment Marks:	**100**

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.

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
Pradhan, J. B. & Pantha, B. R. Integrated Mathematics for Health Science. Sukunda Pustak Bhavan, Bhotahity, Kathmandu.
MS-DOS Manual, Microsoft.
MS-Windows Manual, Microsoft.

Evaluation methods: Written assignments to solve related problems, written examination and practical examination for computer

Teaching / Learning activities and resources: Charts, models, graph boards, diagrams classroom instruction, teacher led discussion, demonstration of solutions, illustration through practical examples.

Part A: Elementary Mathematics

Course: Mathematics and Statistics	Hrs. theory	160	
Unit 1: Elementary Mathematics	**Hrs. theory**	**66**	
Sub-unit 1.1: Set theory and real number system	**Hrs. theory**	**6**	**Hrs. lab**
Objectives:	Content:		
• Define and denote sets. • Find subsets of a set and represent the sets in venn diagrams.	• The concept of sets, specification of sets, representation and types of sets, venn diagrams.		

• Find the union, intersection, complement and difference of given sets. • Define cardinality of a finite set • Solve verbal problems using set operations. • Prove algebra of sets • Define real numbers, absolute value, open and closed intervals and inequalities. • Use the concept of set in selected problems.	• Proof of the Algebra of sets, De-Morgan's law • Problems related to cardinality of sets. • Set operation, set of numbers, Cartesian products and relation, domain and range of relation. • Real number system and the types of numbers, real numbers line, absolute value, open and closed intervals, inequalities.
Sub-unit 1.2: Function and graph	Hrs. theory 6
Objectives:	Content:
• Define a function • Classify functions. • Identify the different functions. • Define domain and range of relation	• Functions and their inverse and related problems. • Composite function and related problems. • Algebraic only. • Domain and range (excluding inverse and composite function) • Exponential and Logarithmic functions
Sub-unit 1.3: Permutation , combination and binomial theorem.	Hrs. theory 9
Objectives:	Content:
• Concept of Basic principles of counting. • Define the permutation {P(n,r)}. • Use of different cases of permutation and Problem relating to permutation(simple cases only). • Define the combination {C(n,r)} and • problem relating to combination (simple cases only) • Define binomial expression and Binomial theorem.	• Introduction of basic counting principle • Definition of permutation • Formula for finding permutation of n – objects taken r at a time. • Application of formula in related problems. • Permutation of repeated use of same objects in an arrangement. • Meaning of combination. • Binomial theorem(without proof) • Finding general term , middle term/s, binomial coefficients and their properties.
Sub-unit 1.4: Matrices and determinants	Hrs. theory 9
Objectives:	Content:
• Define the term matrix. • Write the rows, columns and order of the matrices. • Classify matrices according to their properties. • Define the addition and multiplication of matrices (of order m x n, with its different types in 3x3 order). • Define a determinant and list the properties of a determinant. • Define the inverse of a matrix.	• Definition of matrix and its notation and order • Types of matrices and simple algebra 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)
Sub-unit 1.5: Algebra& Straight Line (Revision only)	Hrs. theory 2

Objectives:	Content:
• 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. • Find the distance two parallel line. • Find the area of triangle. • Define quadratic equations and its roots. • Define the nature of roots.	• Formula of distance between two points and its slope • Angle between two lines and condition of perpendicularity and parallelism. • Distance two parallel line. • Area of triangle. • Quadratic equations , its roots and nature of roots.
Sub-unit 1.6: Co-ordinate Geometry (Equation of a pair of lines)	**Hrs. theory 6**
Objectives:	Content:
• Define line pair equation, express two equation of straight lines as a single equation • Find the condition required for equation of second degree ($ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$) to represent a pair of lines and find the separate equations. • Prove that the equation $ax^2 + 2hxy + by^2 = 0$ always represents a pair of straight lines passing through the origin. • Find the angle between two straight lines represented by the homogeneous equations of second degree. • ($ax^2 + 2hxy + by^2 = 0$)	• Line pair equation, • Two equation of straight lines as a single equation • Condition required for equation of second degree ($ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$) to represent a pair of lines and also find the separate equations. • Proof that the equation $ax^2 + 2hxy + by^2 = 0$ always represents a pair of straight lines passing through the origin. • The angle between two straight lines represented by the homogeneous equations of second degree. ($ax^2 + 2hxy + by^2 = 0$)
Sub-unit 1.7: Limits and limiting values	**Hrs. theory 6**
Objectives:	Content:
• Define the term *limit* and *limiting* value. • Evaluate the limiting values of simple algebraic & trigonometric function. • Use the formula • $\lim_{x\to a} \frac{x^n - a^n}{x-a} = na^{n-1}$ • $\lim_{\theta\to 0} \frac{sin\theta}{\theta} = 1$ Define continuity and identify continous and discontinous function	• *Limit* and *limiting* value. • Limiting values of simple algebraic & trigonometric function. • Using the formula $\lim_{x\to a} \frac{x^n - a^n}{x - a} = na^{n-1}$ $\lim_{\theta\to 0} \frac{sin\theta}{\theta} = 1$ Continuity and identification of continous and discontinous function
Sub-unit 1.8: Derivatives and their Applications (Maxima and Minima)	**Hrs. theory 6**
Objectives:	Content:
• Define the term derivatives. • Apply definition to get derivatives of the functions x^n, $(ax + b)^n$, sin (ax + b), cos (ax + b), e^x and $\log_a x$.	• Definition of the term derivatives. • Geometrical meaning of derivatives.

• Use the sum, difference, product, quotient and chain rule of derivates to calculate the derivates of algebric function only. • Apply derivate to calculate maximum and minimum values of a given algebric function and other related problems.	• Application of definition to get derivatives of the functions x^n, $(ax + b)^n$, sin (ax + b), cos (ax + b), e^x and $\log_a x$. • Using the sum, difference, product, quotient and chain rule of derivates to calculate the derivates of algebric function only. • Application of derivate : - increasing , decreasing and stationary points. - Maximum , minimum values of a given algebric function and point of inflection. - concave upward and concave downward (algebraic only)
Sub-unit 1.9: Integration	**Hrs. theory 10**
Objectives:	Content:
• Define integral as anti-derivative, • Apply techniques of integration as anti-derivative, substitution method, integration by parts and definite integral. • Use definite integral to calculate area enclosed by algebric curve, X-axis and ordinate at x = a to x = b	• Definition of integral as 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
Sub-unit 1.10: Probability	Hrs. theory 6
Objectives:	Content:
• Define probability (classical and empirical) • Application and use addition and multiplication the law of probability • Explain and use binomial probability distribution formula $P(r) = c(n, r)\, p^r q^{n-r}$	• Definition of probability (classical and empirical) • 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

Unit 2: Elementary Statistics	**Hrs. theory 46**
Sub-unit 2.1: Introduction to Statistics (Revision only)	**Hrs. theory 3**
Objectives:	Content:
• Define statistics as given by different writers (Prof. Horace Secrist, Prof. Croxton & Crowden and Prof. Ya-Lu-Chan). • State the utility, functions and limitations of statistics.	• Definitions by Prof. Horace Secrist, Prof. Croxton & Crowden and Prof. Ya-Lu-Chan). • Utility, functions and limitation of statistics.
Sub-unit 2.2: Collection, Classification and Tabulation diagrams and graphs (Revision only)	**Hrs. theory 3**
Objectives:	Content:
• Collect data (primary and secondary) • Classify and tabulate data • Prepare frequency table (ungrouped and grouped form)	• Data Collection (primary and secondary) • Classification and tabulation of data • Preparation of a 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	• Representation of data on simple, multiple, sub-divided, percentage bar diagram and Pie-diagrams. • Representation of data on histogram, frequency polygon, frequency curve and Ogive curve
Sub-unit 2.3: Central tendency	**Hrs. theory 5**
Objectives:	Content:
• Define central tendency • Calculate mean, median, mode, and partition values (Quartiles, Deciles and Percentiles) for ungrouped and grouped data mathematically	• Definition of central tendency • Calculation of mean, median, mode, and partition values (Quartiles, Deciles and Percentiles) for ungrouped and grouped data mathematically
Sub-unit 2.4: Measure of dispersion	**Hrs. theory 8**
Objectives:	Content:
• Calculate range, quartile deviation and standard deviation for ungrouped and grouped data mathematically • Concept of absolute and relative measures of dispersion • Compute coefficient of range, quartile deviation, and variation for ungrouped and grouped data mathematically	• Calculation of range, quartile deviation mean deviation and standard deviation for ungrouped and grouped data mathematically • Absolute and relative measures of dispersion • Computation of coefficient of range, quartile deviation, mean deviation, and variation for ungrouped and grouped data mathematically
Sub-unit 2.5: Correlation Coefficient	**Hrs. theory 9**
Objectives:	Content:
• Define the concept of correlation. • Define correlation method by drawing Scatter diagram • Explain Karl Pearson's coefficient of correlation between two variables. • Define Sparman's rank correlation • Define Probable error , standard error and test of significant of correlation	• Concept of correlation. • Method of studying correlation by drawing Scatter diagram • Calculations of Karl Pearson's coefficient of correlation between two variables. • Sparman's rank correlation. • Probable error , standard error and test of significant of correlation.
Sub-unit 2.6: Vital statistics	**Hrs. theory 10**
Objectives:	Content:
a) Vital Statistics • Define the term vital statistics. • Describe the utility of vital statistics. • Identify the different sources of vital statistics. **b) Measure of Fertility** • Define the meaning of Fertility • Describe different measures of fertility • Compute different indicators related to fertility **c) Measures of mortality** • State the meaning of mortality • Describe different measures of mortality	**a) Vital Statistics** • Definition of the term vital statistics. • Utility of vital statistics. • Different sources of vital statistics. **b) 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) **c) Measures of mortality** • Meaning of mortality • Different measures of mortality

• Compute different indicators related to mortality **d) Measures of morbidity (sickness)** • State the meaning of morbidity • Describe different measures of morbidity • Compute the incidence rate and prevalence rate	• Different indicators related to mortality (crude death rate, specific death rate, infant mortality rate, maternal mortality rate and still birth rate) **d) Measures of morbidity (sickness)** • Meaning of morbidity • Different measures of morbidity • The incidence rate and prevalence rate
Sub-unit 2.7: Research methodology	**Hrs. theory 4**
Objectives:	Content:
• Define the concept of research. • Describe the process and methodology of research by stepwise scientific method or formula application. • Discuss the importance of interpreting research results	• Definition of research • Research methodology. • Steps of research. • Scientific method. • Statistical tools for measuring reliability of results. • Interpreting and understanding research data. • Applications of research in medical science.
Sub-unit 2.8: Introduction to Report Writing	**Hrs. theory 4**
Objectives:	Content:
• 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

Unit 3: Basic Computer Skills	**Hrs. theory 8 Hrs. lab.**
Sub-unit 3.1: Introduction	
Objectives:	**Content:**
• Describe the functions and uses of computers. • Compare and contrast the functions of computer hardware. • Describe and demonstrate the functions of computer hardware. • Describe and demonstrate the functions of computer memory and storage systems. • Demonstrate the procedure for scanning the viruses and removing viruses. • Use a virus protection utility to recover damaged files in a diskette or hard disk.	• Definitions and descriptions of computers and computing activities. • Characteristics of various types and generations of computers. • Computer hardware: CPU, VDU, Input and Output peripherals. • Computer software: systems, applications, and utility software. • Memory: RAM, ROM; storage systems (magnetic, optical), storage types (floppy, hard disk, compact disk), and storage capacities. • Utilities for virus protection. • Operation of virus utilities.

Statistics and Computer

The paper on elementary statistics is designed to supplement the 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 note book 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: **40 hours**

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 mean by shortcut or graphical method.
Find quartiles, deciles and percentiles mathematically and graphically.
Find the mean deviation from mean, median and mode.
Find standard deviation.
Find standard deviation through shortcut method.
Find the coefficient of variation.
Compute prevalence rate of morbidity.
Compute incidence rate of morbidity.
Calculate crude and specific death rate.
Calculate infant mortality rate.
Calculate maternal mortality rate.
Calculate fertility of crude, specific and general birth rate
Calculate fertility rate of natural increment.

Computer: **40 hours**

- Create a directory and file on hard disk under MS-DOS and WINDOW system.
- Open window environment and change the outlook of window.
- Open MS-WORD and create a document explaining statistical methods like function, limitations, graph, diagram and table construction.
- Open MS-EXCEL and create a frequency table and apply formula to calculate mean, median, mode, and standard deviation.
- Create graph and diagrams from MS-EXCEL.
- Open MS-ACCESS and create a database for report writing.
- Operate POWER POINT and prepare presentation.
- Operate VIRUS scanning on hard and removable disks.

(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)