

**Far Western University  
Mahendranagar, Kanchanpur  
Faculty of Science and Technology**



**B. Sc. First Semester Biology Group**

**FAR WESTERN UNIVERSITY**  
**Faculty of Science and Technology**

Course Title: **English Grammar and Composition**  
 Course No.: **C. ENG. 111**  
 Nature of Course: **Theory**  
 Level: **B. Sc.**  
 Year: **First, Semester: First**

F.M.: **100**  
 P.M.: **45**  
 Credit: **3**  
 Number of hours per week: **3**  
 Teaching Hours: **48**

**(1). Course Introduction**

This is a compulsory English course for B. Sc. students irrespective of their major subjects. The course exposes the students to the basic grammar that they require in their day-to-day academic settings at the undergraduate level. The grammar is introduced in context through the texts and further practice is provisioned through exercises. The course also helps students sharpen their reading and writing skills through various texts and composition exercises. Additionally, the course will also introduce critical thinking skills and they will be given opportunities to practice those skills in class through a variety of texts and tasks.

**(2). Objectives**

General objectives of this course are to:

- a) help students produce grammatically correct English
- b) develop writing skills for the academic work at undergraduate level
- c) expose them to the variety of reading texts
- d) give them practice in writing exercises
- e) introduce them to the academic vocabulary items used in academic settings
- f) develop in students the ability to think critically

**(3). Contents in detail with Specific Objectives**

Specific Objectives	Contents in Detail
<ul style="list-style-type: none"> <li>● Make sentences using appropriate tenses in speech and writing</li> <li>● Use modals in the correct syntagmatic patterns</li> <li>● Supply correct prepositions, adjectives and adverbs</li> <li>● Use the right verbs in the given contexts</li> <li>● Use conditionals, clauses, questions in the given contexts</li> </ul>	<b>Unit 1: Grammar (20 hours)</b> Tenses Modals Determiners pronouns and noun phrases Prepositions, adjectives and adverbs Verb structures Word formation Conditionals, clauses, questions, indirect speech Sentences and varieties of English
<ul style="list-style-type: none"> <li>● Predict and preview texts using a variety of strategies</li> <li>● Read for main ideas</li> <li>● Read and comprehend different text types</li> <li>● Read for details</li> <li>● Locate specific information in texts</li> <li>● Use graphic organizer to comprehend the texts</li> <li>● Identify source of information</li> </ul>	<b>Unit 2: Reading (10 hours)</b> Prediction and previewing skill Skimming skill Reading for comprehension Reading for details Scanning skill Reading strategies Reading sources
<ul style="list-style-type: none"> <li>● Develop and analyze paragraphs of different genres</li> <li>● Plan and make outline for writing</li> <li>● Revise, edit and rewrite</li> <li>● Write summaries</li> <li>● Write personal response to the texts</li> <li>● Write different letters</li> <li>● Write different types of essays</li> </ul>	<b>Unit 3: Writing (10 hours)</b> Paragraph writing Preparing outlines Process writing: plan, draft, revise, edit Summary writing Responding to texts Writing letters Writing essays
<ul style="list-style-type: none"> <li>● Use dictionary to find meaning</li> <li>● Identify different types of information in the dictionary</li> <li>● Use academic words in their writing</li> <li>● Find appropriate meaning of new vocabulary in different contexts</li> </ul>	<b>Unit 4: Vocabulary (10 hours)</b> Using a mono-lingual dictionary Differentiate literal meaning and idiomatic meaning Learning selected words from the Academic Word List (AWL) Guessing meaning in contexts Learning phrasal verbs

<ul style="list-style-type: none"> <li>● Use phrasal verbs in the given contexts</li> <li>● Analyze the composition of words</li> </ul>	4.6. Understanding the composition of words and phrases
<ul style="list-style-type: none"> <li>● Explain ideas to demonstrate comprehension</li> <li>● Reflect on the ideas in the texts</li> <li>● Connect ideas across texts or readings</li> <li>● Relate personal experience to the topic</li> <li>● Synthesize information from texts and personal experience</li> <li>● Evaluate experiences and events</li> <li>● Consider social responsibility on various levels</li> </ul>	<b>Unit 5: Critical Thinking (5 hours)</b> Comprehension skills Reflection on the ideas in the texts Connecting ideas across texts or readings Relating personal experience to the topic Synthesizing skills Evaluating experiences and events Considering social responsibility on various levels

#### (4). Evaluation System:

Undergraduate Programs				
External Evaluation	Marks	Internal Evaluation	Weightage	Marks
End semester examination	60	Assignments	10%	40
(Details are given in the separate table at the end)		Quizzes	10%	
		Attendance	10%	
		Presentation	10%	
		Term papers	10%	
		Mid-Term exam	40%	
		Group work	10%	
Total External	60	Total Internal	100%	40
Full Marks 60+40 = 100				

#### (I). External evaluation

**End semester examination:** It is a written examination at the end of the semester. The questions will be asked covering all the units of the course.

Each student must secure at least 50% marks in internal evaluation in order to appear in the end semester examination. Failed student will not be eligible to appear in the end semester examinations.

#### (II). Internal evaluation

**Assignment:** Each student must submit the assignment individually. The stipulated time for submission of the assignment will be seriously taken.

**Quizzes:** Unannounced and announced quizzes/tests will be taken by the respective subject teachers. Such quizzes/tests will be conducted twice per semester. The students will be evaluated accordingly.

**Attendance in class:** Students should regularly attend and participate in class discussion. Eighty percent class attendance is mandatory for the students to enable them to appear in the end semester examination. Below 80% attendance in the class will signify NOT QUALIFIED (NQ) to attend the end semester examination.

**Presentation:** Students will be divided into groups and each group will be provided with a topic for presentation. It will be evaluated individually as well as group-wise. Individual students have to make presentations on the given topics.

**Term paper:** Term paper must be prepared by using computer in a standard format of technical writing and must contain the required number of pages. It should be prepared and submitted individually. The stipulated time for submission of the paper will be seriously taken as one of the major criteria of the evaluation.

**Mid-term examination:** It is a written examination and the questions will be asked covering all the topics in the session of the course.

**Discussion and participation:** Students will be evaluated on the basis of their active participation in the classroom discussions.

**Instructional Techniques:** All topics are discussed with emphasis on real-world application. List of instructional techniques is as follows:

- Lecture and Discussion
- Group work and Individual work
- Self-study
- Assignments
- Presentation by Students
- Term Paper writing
- Quizzes
- Guest Lecture

Students are advised to attend all the classes and complete all the assignments within the specified time period. If a student does not attend the class(es), it is his/her sole responsibility to cover the topic(s) taught during that period. If a

student fails to attend a formal exam/quiz/test, there won't be any provision for re-exam.

**(5). References**

1. Gramer, M.F. and Ward, C. S. (2011). Q: Skills for Success (Reading and Writing) – 3. New York. Oxford University Press. *(All Units)*
2. Lloyd, M. and Day, J. (2011). Active Grammar, Level 3. Cambridge. Cambridge University Press. *(Unit 1)*

**(6). Dictionary**

Hornby. A.S. (2010). Eighth Edition. Oxford Advanced Learner's Dictionary. Oxford: Oxford University Press.

**FAR WESTERN UNIVERSITY**  
**Faculty of Science and Technology**

**Course Title: Fundamentals of Environmental Science TH Course No.: ENV 111**

**Nature of the Course: Theory Level: B.Sc. (Undergraduate) Year: First,**

**Semester: First**

**Total Credit: 3 Instruction hours/week: 3**

**1. Course Description**

The course intends to provide basic theoretical and practical knowledge on Fundamental aspects of Environmental Science. The course has been divided into five units. The first unit deals with Concept, development and scope of Environmental Science. The second unit focuses on Ecology, its associated components and Microbial Ecology. The third unit deliberates basic knowledge on Population and Community Ecology and its application. The fourth unit put emphasis on Concept and types of ecosystem and Pattern of energy flow in Ecosystem. While the fifth unit focuses on interrelation between Environment and Human Society and use of sociological and anthropological knowledge and practices on environmental conservation.

**2. Course Objectives**

The general objectives of the course are as follows:

- To acquaint the students with fundamental aspects of environmental science.
- To familiarize with environment and environmental science
- To give knowledge on ecology and ecosystem
- To develop analytical skills on Population and community analysis.
- To make familiar about the human interaction with environment

**3. Specific Objectives and Contents**

Specific Objectives	Contents
<ul style="list-style-type: none"> <li>● Provide knowledge on concept, historical development, Scope and importance of Environmental Science.</li> <li>● Familiarize with environmental science and its interrelation with other disciplines.</li> </ul>	<p><b>Unit 1: Environment and Environmental Science</b>  <b>5 hrs</b>            Definition, concept and perspectives; historical development; objective, scope and importance; relationship between environmental science with other disciplines; environmental science in Nepalese and global context</p>
<ul style="list-style-type: none"> <li>● Discuss about concept, branches and Scope of Ecology; relation between environmental science and ecology.</li> <li>● Describe about life supporting systems; ecological factors; limiting factors.</li> <li>● Explain about food chain, food web, trophic structure and ecological pyramids</li> </ul>	<p><b>Unit 2: Ecology</b>  <b>10 hrs</b>            Ecology: Definition, preview, branches and scope of ecology; relationship between ecology and environmental science; concept of ecosystem; life supporting systems; ecological factors; limiting factors; laws of limiting factors; ecological basics: terminologies, concept of food chain, food web, trophic structure, ecological pyramids; concept of niche and habitat</p>

<ul style="list-style-type: none"> <li>● Highlight on concept of niche and habitat</li> <li>● Discuss Distribution of microorganisms in the environment; characteristics of bacteria, cyanobacteria, actinomycetes, fungi, algae and protozoan and factors affecting growth of microorganisms.</li> <li>● Provide Knowledge on microbial interaction and concept of bioremediation and biosensors.</li> </ul>	<p>Microbial Ecology: Distribution of microorganisms in the environment: bacteria, cyanobacteria, actinomycetes, fungi, algae and protozoan; factors affecting growth of microorganisms; air, water, soil and food microbes; microbial interaction; concept of bioremediation and biosensors; microbes and human health, Use of microbes as biofertilizer and biopesticides.</p>
<ul style="list-style-type: none"> <li>● Describe Characteristic of population; theory of population growth and population dynamics.</li> <li>● Discuss the concept, characteristics and structure of communities.</li> <li>● Develop analytical skills on Population and community analysis.</li> <li>● Explain the meaning of Species interaction; explain their types with examples and their importance.</li> </ul>	<p><b>Unit 3: Population and Community Ecology</b></p> <p style="text-align: right;"><b>10 hrs</b></p> <p>Population: Basic concept of population ecology; population characteristics; theory of population growth; population dynamics; population regulation.</p> <p>Community: concept, brief history, characteristics and structure; species interaction: positive and negative; linkage population, community and environment</p>
<ul style="list-style-type: none"> <li>● Explain the concept, meaning and different types of ecosystem.</li> <li>● Describe characteristic features and components of ecosystems.</li> <li>● Highlight the structure and functional aspects of pond and forest ecosystems</li> <li>● Describe the meaning and mechanism of biogeochemical cycle.</li> <li>● Discuss about the Energy flow process on ecosystem and its role in ecological balance.</li> <li>● Explain meaning and concept of succession and trend of succession.</li> <li>● Describe different types of productivity and its measurement techniques.</li> </ul>	<p><b>Unit 4: Ecosystem</b></p> <p style="text-align: right;"><b>15 hrs</b></p> <p>Ecosystem: concept and types; terrestrial and aquatic ecosystems; structure and functional aspects of pond and forest ecosystems; biogeochemical cycle: gaseous, sedimentary and hydrological; energy flow; succession; productivity: primary and secondary</p>

<ul style="list-style-type: none"> <li>● Describe about development of human civilization and their socio-cultural perspective regarding environmental resources.</li> <li>● Explain about nexus population growth and environmental degradation.</li> <li>● Discuss the use of sociological and anthropological knowledge and practices on environmental conservation.</li> <li>● Explain the meaning of environmental sustainability: approach and principles</li> <li>● Highlight the environmental world views and ethics.</li> </ul>	<p><b>Unit 5: Environment and Human Society</b></p> <p style="text-align: right;"><b>5hrs</b></p> <p>Environmental resources and socio-cultural perspective; human civilization and resources; nexus population growth and environmental degradation; use of sociological and anthropological knowledge and practices on environmental conservation; environmental sustainability: approach and principles; environmental world views and ethics</p>
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**Text Books :**

1. Miller, Jr. G. T. (2003). *Living in the Environment*: Wadsworth Publication.
2. Odum, E. P. (1996). *Fundamentals of Ecology*: Saunders Company, USA
3. Sharma .P.D. Ecological and Environmental. Rostogi Publication, India

**References:**

1. Cunningham, W.P & Cunningham, M.A. (2004). *Principles of Environmental Science: Inquiry and Applications*, Second Edition. Boston: Mc Grow Hill.
2. Kormondy, E. J. (1996). *Concepts of Ecology*: Prentice-Hall of India, New Delhi.
3. Odum, E. P. and Barrett, G. W. (2005). *Fundamentals of Ecology*, 5<sup>th</sup> Edition, Saunders Company, USA.
4. Richard T. (2008). *Environmental Science, Toward a Sustainable Future*, PHI (P) Limited, India
5. Santra, S.C. (2004). *Environmental Science*, New Central Book Agency (P) Ltd. India.
6. Sharma .P.D. Ecological and Environmental. Rostogi Publication, India
7. Francis A. (1982). *Modern Sociological Theory: An Introduction*, Oxford University Press, New Delhi
8. Pelczar M.J. 2010. *Microbiology, An Application based approach*, second reprint, 2010 ,Tata McGraw-Hill Co, New Delhi.

**FAR WESTERN UNIVERSITY**  
**Faculty of Science and Technology**

**Course Title: Fundamentals of Environmental Science PR**

**Course No: ENV111**

**Total Credit: 1**

**Year: First**

**Semester: First**

**Nature of Course: Practical**

**Practical No.**

1. Enumeration of floral and faunal diversity of terrestrial ecosystem
2. Measurement of population and community parameters: density, frequency, abundance, community composition, similarity index, species-area-curve, minimum number of sampling units, species diversity of vegetation and animals by quadrat method.
3. Measurement of primary productivity (using different methods)
4. Biological analysis of soil from grassland/cropland/forest ecosystems
5. Instrumentation and working principle: compound microscope, hot air oven, autoclave, incubator, biological safety cabinet, water bath and related instruments
6. Analysis of bacterial population (staining, enumeration)
7. Visit to nearby forest /grassland ecosystem to enumerate floral and faunal diversity
8. Visit to nearby health post/Municipality/DDC to assess the environmental administration and management system.
9. Visit to human settlement area for socio economic and cultural study and prepare a project report.

**Some major points related to aforementioned practical:**

1. Students have to carry out *one day field visit* to nearby national park/wildlife reserve for conducting practical number **1, 2, 7 and 9**. Since the field work is for complete academic purpose. For this purpose University will have to support students for necessary transportation cost. Total two separate field visits will be held. First field visit will address practical number 1, 2, 7 and second field visit will address practical number 9.
2. Students have to prepare a field report for practical no. **8 and 9** and submit during practical examination.
3. Students have to submit a field note book of all field visits during practical examination.



**FAR WESTERN UNIVERSITY**  
**Faculty of Science and Technology**

Course Title: General Microbiology, Microbial Structure, Physiology and Genetics  
 Course No.: MIB111  
 Nature of Course: Theory  
 Level: B. Sc.  
 Year: First, Semester: First

F.M.: 100  
 P.M.: 45%  
 Credit: 3  
 Number of hours per week: 3  
 Teaching Hours: 45

**1. Course Description**

The course intends to enable the students to be acquainted with the scope and applications of microbiology. The aim of the course is to provide fundamental knowledge and basic practical skills on, taxonomy, Structure and physiology and genetics of bacteria, virus and fungi

**2. Course Objectives**

After the completion of the course the students will be able to understand

- the concept of the microbial world, classification schemes and the nomenclature of microorganisms
- scope and application of Microbiology, beneficial and harmful roles of microorganism, determinative characteristics of bacteria, animal viruses and fungi and protozoan parasites
- growth, physiology, metabolism, genetics and ecology of microorganisms and,
- They will be able to perform isolation, enumeration and conventional identification of Bacteria, Fungi and Virus.

**3. Specific Objectives and Contents**

Specific Objectives	Contents in Detail
<ul style="list-style-type: none"> <li>● To give knowledge on history of and development of microbiology as a modern science</li> <li>● To explain the differential characteristics of prokaryotic and eukaryotic microorganism</li> <li>● To compare and contrast determinative characteristics of bacteria, viruses, fungi and protozoan parasites</li> <li>● To discuss applications and scope of microbiology in other fields of modern science and technology</li> </ul>	<p><b>Unit I: Development of Microbiology and Microbial World (3 hrs)</b>            Concept of the microbial world, differential characteristics of prokaryotic and eukaryotic microorganism and determinative characteristics of bacteria, viruses, fungi and protozoan parasites, Scope and application of microbiology, beneficial and harmful roles of microorganism, important discoveries related to development of microbiology, Discovery of microscope, Spontaneous generation theory, Germ theory of disease and other important recent discoveries</p>
<ul style="list-style-type: none"> <li>● To describe the Importance of aseptic techniques in Microbiology</li> <li>● To explain the methods and procedure to be followed for the sterilization and Disinfection</li> <li>● To describe principle of each of the physical and chemical methods used for removal and control of microorganism</li> <li>● To explain and discuss Working principle of instruments and methods used for growth, recovery enumeration, isolation and identification and removal of microorganism</li> <li>● To explain working principle of Hot Air Oven, Autoclave, Incubator, Laminar UV safety cabinet and Spectrophotometer</li> </ul>	<p><b>Unit II: Handling and Control of Microorganisms (5 hrs)</b>            Importance of aseptic techniques in Microbiology. Principles of sterilization and Disinfection, control of micro-organisms by Temperature, Irradiation, Ultrasonication, Filtration, Chemicals, Antibiotics and other chemotherapeutic agents, Working principle of Hot Air Oven, Autoclave, Incubator, Laminar UV safety cabinet and Spectrophotometer</p>
<ul style="list-style-type: none"> <li>● To explain importance, procedure and application of different bacterial staining techniques</li> <li>● To explain instrumentation and working principle of Compound Microscope, Phase Contrast Microscope, SEM and TEM</li> <li>● To explain methods of Bacteriological Culture Medium preparation</li> <li>● To describe Techniques of Isolation and Enumeration and identification of Bacteria</li> </ul>	<p><b>Unit III: Techniques of Isolation, Enumeration and Identification of Bacteria (5 hrs)</b>            Application of microscopy and staining in Microbiology: Types of microscope, Compound Microscope, Phase Contrast Microscope, SEM and TEM. Types of staining for bacterial identification and nature of dyes, Gram's staining, Negative staining, Flagella staining, Spore staining, Capsule staining, ZiehlNeelson staining.            Types of Bacteriological Culture Medium, Techniques of Isolation and Enumeration of Bacteria i.e. streak plate technique, pour plate technique, spread plate technique, MF, MPN, DMC, Methods of anaerobiosis and Anaerobic of culture of Bacteria, Methods of</p>

	culture maintenance, conventional biochemical testing of Bacteria: Catalase test, Oxidase test, Urease test Sugar Fermentation, Indole test, MR. tests, VP test, TSI test, Nitrate reduction test, Starch hydrolysis, Lipid hydrolysis, Protein hydrolysis, techniques of motility determination and micrometry of Bacteria
<ul style="list-style-type: none"> <li>Explain the Basis of Classification, Nomenclature and Characterization of Bacteria according to Bergey's Manual of Systematic Bacteriology</li> <li>Describe the Morphological characteristics of bacterial cell and fine structure and function of cell organelles</li> <li>General Characteristics of common Gram negative and Gram positive Bacteria, Structure and functions of bacterial Cell</li> <li>Explain the entry of nutrients and kinetics of bacterial growth and its measurement</li> <li>Discuss the factors affecting growth</li> </ul>	<b>Unit IV: Classification, Growth and Physiology of Bacteria (12 hrs)</b> Basis of Classification, Nomenclature and Characterization of Bacteria according to Bergey's Manual of Systematic Bacteriology. Morphological characteristics of bacterial cell and fine structure and function of cell organelles. General Characteristics of common Gram negative and Gram positive Bacteria, Structure and functions of bacterial Cell wall, Cell membrane, Capsule, Spore, Flagella, Pili and other cell organelles. Nutritional types of bacteria i.e. photolithotrophic, chemolithotrophic, photoorganotrophic, chemoorganotrophic. Entry of nutrients, Passive and Active transport. Microbial Growth, Growth Curve, Factors affecting the growth.measurementof the Bacterial growth and generation time calculation
<ul style="list-style-type: none"> <li>To explain basic concept Enzyme regulation in prokaryotic and eukaryotic organism</li> <li>Discuss the process and biochemistry of Metabolism of Carbohydrate and ATP production, and significance</li> </ul>	<b>Unit V: Microbial Metabolism (5 hrs)</b> Concept of Enzyme regulation in prokaryotic and eukaryotic organism, lac Operon, Metabolism of Carbohydrate and ATP production, Mechanism and significance of Glycolysis, TCA cycle, fermentative pathways and electron transport system Oxidative and substrate level phosphorylation, Different types of fermentative pathways
<ul style="list-style-type: none"> <li>Explain concepts of bacterial and viral genetics</li> <li>Explain the prokaryotic genome, genetic code, plasmids</li> <li>To describe bacterial recombination</li> </ul>	<b>Unit VI: Microbial Genetics (5 hrs)</b> Prokaryotic genome, genetic code, plasmids, concepts of bacterial and viral genetics and role of RNA & DNA, bacterial recombination- transformation, conjugation & transduction
<ul style="list-style-type: none"> <li>To describe classification, reproduction and life cycle of common Yeast and Mold</li> <li>To explain structure, lifecycle and general properties of medically important Protozoan and Helminthic parasites</li> <li>To classify the general structure, properties of animal virus and Bacteriophages and rescue of common human virus</li> </ul>	<b>Unit VII: Eukaryotic Microorganism (5 hrs)</b> Classification, Reproduction and life cycle of common Yeast and Mold, Structure, Lifecycle and General properties of medically important Protozoan and Helminthic parasites  <b>Unit VIII: Viruses: (5)</b> Taxonomy Classification General Structure, properties and Classification schemes of animal Virus and Bacteriophages, Virus cell interactions and viral replication, Techniques of cultivation, identification, enumeration and rescue of common human viruses

#### (4). Evaluation System:

Undergraduate Programs				
External Evaluation	Marks	Internal Evaluation	Weightage	Marks
End semester examination	60	Assignments	10%	40
(Details are given in the separate table at the end)		Quizzes	10%	
		Attendance	10%	
		Presentation	10%	
		Term papers	10%	
		Mid-Term exam	40%	
		Group work	10%	
Total External	60	Total Internal	100%	40
Full Marks 60+40 = 100				

### **(I). External evaluation**

**End semester examination:** It is a written examination at the end of the semester. The questions will be asked covering all the units of the course.

Each student must secure at least 50% marks in internal evaluation in order to appear in the end semester examination.

Failed student will not be eligible to appear in the end semester examinations.

### **(II). Internal evaluation**

**Assignment:** Each student must submit the assignment individually. The stipulated time for submission of the assignment will be seriously taken.

**Quizzes:** Unannounced and announced quizzes/tests will be taken by the respective subject teachers. Such quizzes/tests will be conducted twice per semester. The students will be evaluated accordingly.

**Attendance in class:** Students should regularly attend and participate in class discussion. Eighty percent class attendance is mandatory for the students to enable them to appear in the end semester examination. Below 80% attendance in the class will signify NOT QUALIFIED (NQ) to attend the end semester examination.

**Presentation:** Students will be divided into groups and each group will be provided with a topic for presentation. It will be evaluated individually as well as group-wise. Individual students have to make presentations on the given topics.

**Term paper:** Term paper must be prepared by using computer in a standard format of technical writing and must contain the required number of pages. It should be prepared and submitted individually. The stipulated time for submission of the paper will be seriously taken as one of the major criteria of the evaluation.

**Mid-term examination:** It is a written examination and the questions will be asked covering all the topics in the session of the course.

**Discussion and participation:** Students will be evaluated on the basis of their active participation in the classroom discussions.

**Instructional Techniques:** All topics are discussed with emphasis on real-world application. List of instructional techniques is as follows:

- Lecture and Discussion
- Group work and Individual work
- Self-study
- Assignments
- Presentation by Students
- Term Paper writing
- Quizzes
- Guest Lecture

Students are advised to attend all the classes and complete all the assignments within the specified time period. If a student does not attend the class(es), it is his/her sole responsibility to cover the topic(s) taught during that period. If a student fails to attend a formal exam/quiz/test, there won't be any provision for re-exam.

### **5. Reference Books (MIB111 & MIB112)**

1. Michael J. Pelczar, JR, E.C.S Chan, Noel R. Krieg, Microbiology, Tata McGraw Hill 5<sup>th</sup> edition, 1993
2. James G Cappucino and Natalie Sherman, Microbiology, A Laboratory Manual, Benjamin Cumings Inc. California, 4<sup>th</sup> edition, 1996
3. Madigan MT, MartinkoJM and Parker J. Brock's Biology of Microorganisms, 10<sup>th</sup> Edition, Prentice-Hall International (2004).
4. Collins and Lynes Microbiological Methods C.H. Collins, Patricia M. Lyne, J. M. Grange, Butter Worth, Oxford, 7<sup>th</sup> edition, 1995
5. David Greenwood, Richard CD, Slak John ForstPeuther, Medical Microbiology, ELBS, Churchill living stone, 16<sup>th</sup> edition, 1992
6. Bergey's Manual of Systematic Bacteriology, Volume 1 (2001), Volume 2 (2005), Volume 3(2009), Volume 4 (2009), Volume 5 (2009)
7. Bhatta D.R., Bacteriophages, Taxonomy, applications and research methods, Central department of microbiology, Tribhuvan University Kirtipur, ISBN 9789937218658, First edition 2009

**FAR WESTERN UNIVERSITY**  
**Faculty of Science and Technology**

Course Title: General Microbiology Lab

Course No.: MIB111

Nature of Course: Practical

Level: B. Sc.

Year: First, Semester: First

Credit: 1

Number of hours per week: 3

Teaching Hours: 45

1. To operate and learn working principle of: Compound Microscope, Phase Contrast Microscope, SEM and TEM, Hot Air Oven, Autoclave, Incubator, UV safety hood and Spectrophotometer.
2. To perform: Simple staining, Gram's staining, Negative staining, Flegella staining, Spore staining and Capsule staining, Ziehl Neelson staining
3. To perform Catalase test, Oxidase test, Urease test Sugar Fermentation, Indole test, MR. tests, VP test, TSI test, Nitrate reduction test, Starch hydrolysis, Lipid hydrolysis, Protein hydrolysis,
4. To prepare Nutrient Agar, MacConkey Agar, Blood Agar and Potato Dextrose Agar
5. To Perform Isolation and Enumeration of Bacteria by Streak Plate technique, Spread Plate technique, Pour Plate technique, MPN and MF method
6. To determine the size of Bacteria by Micrometry technique
7. To determine the motility of Bacteria
8. To measure the Bacterial growth and calculate the generation time
9. To study effect of Temperature, pH, Salt concentration, Sugar concentration on microbial growth
10. To perform yeast and mold count and morphological identification of fungi
11. To perform culture of anaerobic Bacteria
12. To perform Antibiotic Susceptibility Testing of Bacteria by Kirby-Bauer disk diffusion technique
13. To Isolate Bacteriophages

**FAR WESTERN UNIVERSITY**  
**Faculty of Science and Technology**

Course Title: **Information Technology Fundamentals**  
Course No.: **COM. 111**  
Nature of Course: **Theory**  
Level: **B. Sc.**  
Year: **First, Semester: First**

F.M.: **100**  
P.M.: **45**  
Credit: **3**  
Number of hours per week: **3**  
Total Hours: **45**

**(1). Course Introduction**

Fundamental concept of Information technology, Computer systems, computer hardware and Software, input, output and storage devices, Binary system, programming languages, Data files and DBMS, fundamental concept of telecommunication, networking and internet and application of computer systems.

**(2). Objectives**

This course introduces fundamental concepts of Information Technology and Computer Systems.

**(3). Contents in detail with Specific objectives**

Specific Objectives	Contents
<ul style="list-style-type: none"> <li>● What is data and information?</li> <li>● Describe processing cycle.</li> <li>● Describe what is hardware and software.</li> <li>● Understand the evolution of computers, from refining of abacus to supercomputers.</li> <li>● Understand the advancement in technology that has changed the way computers operate, efficient, size, and cost.</li> <li>● Classify different computers, networks, software's</li> <li>● Understand computer programming languages</li> <li>● Classify different programming languages</li> <li>● Understand the purpose of programming languages, facilities and various common examples.</li> </ul>	<p><b>Unit I: Computer Concepts (4 Hrs)</b> Ideas of Information, Information Processing and Data. The Data Processing Cycle. Examples of computer applications. Definition of Hardware; broad classes of computers (mainframe, mini and microcomputers) and networks. Computer programs. The computer as a programmable device. Classes of software (system and application). Programming languages: purpose, facilities and common examples.</p>
<ul style="list-style-type: none"> <li>● Understand the basic units of computer system (Anatomy of a Digital Computer)</li> <li>● Understand how the basic digital computer is organized</li> <li>● Describe the purpose of basic units of computer systems.</li> </ul>	<p><b>Unit II: Computer Hardware (4 Hrs)</b> The Central Processing Unit (Control Unit, Arithmetic and Logic Unit, Main Memory). Peripherals. The organization of a simple computer. The storage of programs and data. Data and Control paths in the computer (buses or highways). The Fetch-execute Cycle.</p>
<ul style="list-style-type: none"> <li>● Learn about the digital symbols, base.</li> <li>● Understand with the coding schemes for the internal storage of characters.</li> <li>● Understand what are on-line and off-line peripherals and data.</li> <li>● Understand what is verification and validation of data.</li> </ul>	<p><b>Unit III: Data (2 Hrs)</b> Its Representation and Input: The Stages (collection, Preparation, verification, input methods). Input Devices and Media. On-line and Off-line peripherals. Verification and Validation methods.</p>
<ul style="list-style-type: none"> <li>● Familiarize with the various types of input devices along with their advantages, disadvantages, and applications.</li> </ul>	<p><b>Unit IV: Input Devices (2 Hrs)</b> Description of common input devices and media (such as keyboards, light pens, mice, magnetic stripe readers, punched media, magnetic and optical character recognition, mark readers...), including simple physical principles of operation and practical applications.</p>
<ul style="list-style-type: none"> <li>● Familiarize with the various types of output devices to get desired result that may be in various from viz text, graphics, audio, and video; along with their advantages, disadvantages, and applications.</li> </ul>	<p><b>Unit V: Output Methods, Devices and Media (2Hrs)</b> Description of Displays, Printers, Plotters and Computer Output on Microfilm, including simple physical principles of operation and applications.</p>

<ul style="list-style-type: none"> <li>• Understand the purpose of memory.</li> <li>• Familiarize with the different category of memories, units of storage, access time.</li> <li>• Discuss various types of primary and secondary memories with their storage organization.</li> </ul>	<p><b>Unit VI: Computer Storage (4 Hrs)</b>  Levels of storage: register, main and backing store. Units of storage (bytes and words) and capacities (Kbytes, Mbytes, Gbytes and TBytes). Definition of Access Time. Principles of construction of magnetic tape drives, magnetic disc drives (floppy and hard drives), CD-ROM and DVD; recordable and rewritable compact discs: CD-R and CD-RW.</p>
<ul style="list-style-type: none"> <li>• Learn about the binary number system and its advantages.</li> <li>• Representation of various number systems, methods of number system conversions.</li> <li>• Specify the rules to perform four principle arithmetic operations- addition, subtraction, multiplication, division of binary numbers with the help of suitable examples</li> <li>• Define two types of real numbers viz. fixed point representation, floating point representation; within floating point(non-normalized and normalized) and their representations in computer memory</li> <li>• Understand truth table and half-adder and full-adder operations</li> </ul>	<p><b>Unit VII: The Binary System (5 Hrs)</b>  Reasons for employing binary in a computer. The advantages and disadvantages of binary. The binary representation of numbers, characters and program instructions. Octal and Hexadecimal forms. Conversion between decimal, binary, octal and hexadecimal integers. Binary addition. Arithmetic overflow. Boolean logic. Simple AND, OR and NOT functions in two and three variables. Truth Tables. Half-adder and Full-adder logic. Logic diagrams.</p>
<ul style="list-style-type: none"> <li>• Discuss the prominent concepts to natural languages and computer languages.</li> <li>• Acquaints with the different generations of programming languages with their advantages and disadvantages</li> <li>• Elaborates the stages required during translation process (HLL, Assembly language to machine code).</li> <li>• Understand the concept of visual programming language and platform independent.</li> <li>• Outlook on the basic role of operating system in modern day computers;</li> <li>• Learn about the different types of operating systems;</li> <li>• Provide an overview of UNIX/LINUX operating system.</li> </ul>	<p><b>Unit VIII: Programming Languages (7 Hrs)</b>  Ideas of generations of programming languages: fourth generation (4GL), third generation ('high level'), assembly and binary machine code. Suitable applications for each level; comparisons between the levels. Translator programs - compilers, interpreters and assemblers; source code and object code. The concept of 'visual' languages. Java and the platform independence of its programs. The concept of operating system, functions of operating system, component of operating system, types of operating system. An overview of UNIX operating system.</p>
<ul style="list-style-type: none"> <li>• Understand the concept behind database, file, record, field and character.</li> <li>• Understand different types of data files and access methods.</li> </ul>	<p><b>Unit IX: Data Files (4 Hrs)</b>  Definitions of file, record, field and character. The concepts of file organization file access and file processing (updating). The main types of data file such as master and transaction. Serial, sequential and indexed sequential organization. Direct access and serial access. Updating sequential (tape or disc) files and indexed sequential files. Concepts of a simple database.</p>
<ul style="list-style-type: none"> <li>• Explain the computer related terms, communication networks, and flow of information through different forms of channel.</li> <li>• Understand the concept of serial and parallel transmission, different transmission modes.</li> </ul>	<p><b>Unit X: Simple Telecommunications (4 Hrs)</b>  Serial and Parallel transmission compared. Simplex, Half-duplex and Duplex modes. Modems and Multiplexors. Simple Interfaces. Character Codes. Basic communications facilities and the concept of bandwidth.</p>
<ul style="list-style-type: none"> <li>• Understand the various applications of computer systems in different organizations in terms of purpose, hardware, data, processes, outputs, advantages and limitations.</li> </ul>	<p><b>Unit XI: Common Applications of Computer Systems (4 Hrs)</b>  Non-technical descriptions (purpose, hardware, data, processes, outputs, advantages and limitations) in banking, education, engineering, police, hospitals, credit reference, meteorology, airline reservation and stock control.</p>
<ul style="list-style-type: none"> <li>• Describe computer networks and its various types.</li> <li>• Discuss various computer network topologies.</li> </ul>	<p><b>Unit XII: Networking and the Internet (6 Hrs)</b>  Concepts of Local Area Networks, Wide Area Networks and</p>

<ul style="list-style-type: none"> <li>• Understand the concept of WWW, Internet in terms of their uses, advantages and disadvantages.</li> <li>• Learn about the different browsers and its uses.</li> <li>• Learn various internet application viz email, FTP.</li> <li>• Understand fundamental concepts of HTTP and its uses.</li> </ul>	<p>the Internet. Computer network topologies. The World Wide Web: the concept, its uses and possible disadvantages. Internet Service Providers. Web pages: construction and access; the role of Hypertext Markup Language (HTML) and Java. The concept of electronic mail and its basic uses. The basic functions of browsers.</p>
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**(4). Evaluation System:**

Undergraduate Programs							
External Evaluation	Marks	Internal Evaluation	Weight age	Marks	Practical	Weight age	Mark
End semester examination	60	Assignments	10%	20	Practical Note copy	25%	20
(Details are given in the separate table at the end)		Quizzes	10%		Viva	25%	
		Attendance	10%		Experimental	50%	
		Presentation	10%				
		Term papers	10%				
		Mid-Term exam	40%				
		Group work	10%				
Total External	60	Total Internal	100%	20		100%	20
Full Marks 60+20+20 = 100							

**(I). External evaluation:**

**End semester examination:**

It is a written examination at the end of the semester. The questions will be asked covering all the units of the course.

**External Practical Evaluation:**

After completing the end semester theoretical examination, practical examination will be held. External examiner will conduct the practical examination according to the above mentioned evaluation. There will be an internal examiner to assist the external examiner. Three hours time will be given for the practical examination. In this examination Students must demonstrate the knowledge of the subject matter.

Each student must secure at least 50% marks in internal evaluation in order to appear in the end semester examination. Failed student will not be eligible to appear in the end semester examinations.

**(II). Internal evaluation**

**Assignment:** Each student must submit the assignment individually. The stipulated time for submission of the assignment will be seriously taken.

**Quizzes:** Unannounced and announced quizzes/tests will be taken by the respective subject teachers. Such quizzes/tests will be conducted twice per semester. The students will be evaluated accordingly.

**Attendance in class:** Students should regularly attend and participate in class discussion. Eighty percent class attendance is mandatory for the students to enable them to appear in the end semester examination. Below 80% attendance in the class will signify NOT QUALIFIED (NQ) to attend the end semester examination.

**Presentation:** Students will be divided into groups and each group will be provided with a topic for presentation. It will be evaluated individually as well as group-wise. Individual students have to make presentations on the given topics.

**Term paper:** Term paper must be prepared by using computer in a standard format of technical writing and must contain the required number of pages. It should be prepared and submitted individually. The stipulated time for submission of the paper will be seriously taken as one of the major criteria of the evaluation.

**Mid-term examination:** It is a written examination and the questions will be asked covering all the topics in the session of the course.

**Discussion and participation:** Students will be evaluated on the basis of their active participation in the classroom discussions.

**Instructional Techniques:** All topics are discussed with emphasis on real-world application. List of instructional techniques is as follows:

- Lecture and Discussion
- Group work and Individual work
- Self-study
- Assignments
- Presentation by Students
- Term Paper writing
- Quizzes
- Guest Lecture

Students are advised to attend all the classes and complete all the assignments within the specified time period. If a student does not attend the class(es), it is his/her sole responsibility to cover the topic(s) taught during that period. If a student fails to attend a formal exam/quiz/test, there won't be any provision for re-exam.

**(5). Recommended Books:**

- Longmans , **Glossary of Computing Terms, British Computer Society**, ISBN 0582-36967-3 or ISBN 0582-47594-5
- C S French , **Computer Science**, Fifth edition; Continuum; ISBN 0-8264-5460-7
- Geoffrey Knott and Nick Waites, **Computing**, Third edition; Business Education Publishers; ISBN 1901-888215
- Capron and Johnson, **Computers: Tools for an Information Age**, Eighth edition; Prentice Hall; ISBN 0-13-122723-8
- Ray Bradley; Stanley Thornes, **Understanding Computer Science**, ISBN 0-7487-4046-5
- Alexis Leon, Mathews Leon, **Fundamentals of Information Technology**, Leon TechWorld
- V. Rajaraman, **Fundamentals of Computers**.



**FAR WESTERN UNIVERSITY**  
**Faculty of Science and Technology**

Course Title: **Systematic and Animal Diversity: Lower non- chordate**

Nature of the Course: **Theory**

Credit: **3**

Course No.: **Zoo 111**

Level: **B. Sc.**

Total hours: **45**

Year: **First**

Semester: **First**

### 1. Course Description

The course intends to enable the students to be acquainted with the basic concepts of systematics, classification of non- chordates and basic structures and function of invertebrate organism.

### 2. Course Objectives:

The general objectives of the courses are as follows.

- Understanding the zoological terms, concepts, facts, phenomenon & their interrelationships
- Develop the knowledge of animal science
- Impart knowledge on fundamental principles of animal systematic
- Classify the non-chordates up to Order with their examples.
- Know the functional anatomy of typical representative/s of each Phylum.
- Describe the systems: Polymorphism and Parasitism in non-chordates
- Understand the concept of Coelome, Nephridia and Metamerism in non-chordates.

### 3. Courses Contents

Specific objectives	Contents
<ul style="list-style-type: none"><li>● Explain the principles of the taxonomy, zoological nomenclature.</li><li>● Explain system of zoological classification.</li></ul>	<b>I. Systematics (08)</b> 1 Introduction to taxonomy, 2 Zoological nomenclatures; 3 Taxonomic characters 4 Zoological classifications 5. Criteria for classification of multicellular animals
	<b>II. Animal Diversity- Lower non- chordate</b>

<ul style="list-style-type: none"> <li>Classify lower non-chordate phyla with typical examples and distinctive features.</li> </ul>	<p><b>1. Classification of lower non- chordate ( 08)</b>  General characters and classification of Protozoa, Porifera, Coelenterate, platyhelminthes, Aschelminthes and Annelida up to orders with examples showing distinctive / adaptive features.</p>
<ul style="list-style-type: none"> <li>Understand mode of locomotion, nutrition and reproduction of Euglena,</li> <li>Describe some parasitic protozoan with mode of infection and disease caused</li> </ul>	<p><b>2. Protozoa (07)</b>  Study of Euglena (locomotion, nutrition and reproduction)  Parasitic protozoans: <i>Entamoeba</i>, <i>Giardia</i>, <i>Trypanosoma</i>, <i>Leishmania</i> (diagnostic characters, mode of infection and diseases caused)</p>
<ul style="list-style-type: none"> <li>Describe functional anatomy of sycon, and canal system and skeletal systems of porifera.</li> </ul>	<p><b>3. Porifera (03)</b>  Study of <i>Sycon</i> (structure, skeleton and canal system)  Canal system  Skeletal System</p>
<ul style="list-style-type: none"> <li>Understand the structures and reproduction of Obelia.</li> <li>Describe polymorphism and coral formation</li> </ul>	<p><b>4. Coelenterata (04)</b>  Study of Obelia (structure and reproduction)  4.2 Polymorphism  4.2. Coral reefs and coral</p>
<ul style="list-style-type: none"> <li>Discuss the structures, physiology and parasitic adoptions of important parasites.</li> </ul>	<p><b>5. Platyhelminthes (05)</b>  <i>Taenia solium</i>, <i>Schistosoma haematobium</i> and <i>Fasciola hepatica</i>: structure, reproduction, life-cycle, pathogenecity and control measures.  Parasitic adaptations of helminths</p>
<ul style="list-style-type: none"> <li>Describe structure and life cycle of <i>Ascaris</i>.</li> <li>Discuss diagnostic characters, mode of infections and disease caused by some nematode parasites</li> </ul>	<p><b>6. Nemathelminthes (05)</b>  <i>Ascaris</i>: structure, reproduction and life-cycle  Nematode parasites of man: <i>Ascaris lumbricoides</i>, <i>Ancylostoma duodenale</i>, <i>Trichuris trichura</i> and <i>Wuchereria bancrofti</i>: diagnostic characters, mode of infection and diseases caused</p>
<ul style="list-style-type: none"> <li>Describe structure, life cycle and pathogenicity of <i>Hirudinaria</i>.</li> <li>Discuss about coelome, nephridia and metamerism</li> </ul>	<p><b>7. Annelida (05)</b>  <i>Hirudinaria</i>: Structure, physiology, life cycle, pathogenesity and parasitic adaptation  Coelome  Nephridia  Metamerism</p>

*Note: The figures in the parentheses indicate the approximate periods for the respective units. In addition to teaching hours (45), there will be 3 hours for reviews.*

Undergraduate Programs							
External Evaluation	Marks	Internal Evaluation	Weight age	Marks	Practical	Weight age	Mark
End semester examination	60	Assignments & Presentation	20%	20	Practical Report copy	25%	20
(Details are given in the separate table at the end)		Quizzes	10%		Viva	25%	
		Attendance	20%		Practical Exam	50%	
		Internal Exams	50%				
Total External	60	Total Internal	100%	20		100%	20
Full Marks 60+20+20 = 100							

### 1. External evaluation

#### (i) End semester examination:

It is a written examination at the end of the semester. The questions will be asked covering all the units of the course.

External Practical Evaluation:

After completing the end semester theoretical examination, practical examination will be held. External examiner will conduct the practical examination according to the above mentioned evaluation. There will be an internal examiner to assist the external examiner. Three hours time will be given for the practical examination. In this examination Students must demonstrate the knowledge of the subject matter.

Each student must secure at least 50% marks in internal evaluation in order to appear in the end semester examination. Failed student will not be eligible to appear in the end semester examinations.

### 2. Internal evaluation

- (i). **Assignment:** Each student must submit the assignment individually. The stipulated time for submission of the assignment will be seriously taken.
- (ii). **Presentation:** Students will be divided into groups and each group will be provided with a topic for presentation. It will be evaluated individually as well as group-wise. Individual students have to make presentations on the given topics.
- (iii). **Quizzes:** Unannounced and announced quizzes/tests will be taken by the respective subject teachers. Such quizzes/tests will be conducted twice per semester. The students will be evaluated accordingly.
- (iv). **Attendance in class:** Students should regularly attend and participate in class discussion. Eighty percent class attendance is mandatory for the students to enable them to appear in the end semester examination. Below 80% attendance in the class will signify NOT QUALIFIED (NQ) to attend the end semester examination.
- (v). **Mid-term examination:** It is a written examination and the questions will be asked covering all the topics in the session of the course.

### 3. Prescribed Texts

1. Barnes, R. D. 1981. Invertebrate Zoology. Saunders College Publ.
2. Barnes, R. B., R.S.K. & Calow, P. P. 2001. The Invertebrates: A Synthesis. Wiley-Blackwell.
3. Barrington: Invertebrate Structure and Function (Nelson)
4. Moore: An introduction to the invertebrates (Cambridge)

5. Kotpal, Agarwal and Khetrapal: Modern Textbook of Zoology: Invertebrate, ( Rastogi)
6. Marshall: Parker and Haswell Textbook of Zoology, Vol. I (A.Z.T.B.S. Publishers & Distributors. New Delhi).
7. Jordon and Verma: Invertebrate Zoology (S. Chand)
8. Hickman, Hickman & Roberts. Integrated principles of zoology, Mosby college publication. St. Louis.
- 9-. Ruppert, E. E., R. S. Fox, and R. D. Barnes (2004). Invertebrate Zoology, 7th ed., Thomson Brooks/Cole Publ
10. Anderson, D. T.. 2006. Invertebrate Zoology. Oxford Univ. Press.
11. Brown, F. A. 2002. Invertebrates. Daya Publishing House.
12. Brusca, R.C. & Brusca, G.J. 2003. Invertebrates. Sinauer Associates, Inc.
13. Buchsbaum, R., Buchsbaum, M., Pearse, J. & Pearse, V. 1987. Animals without backbones: An Introduction to the Invertebrates. 3rd edition. University of Chicago Press.
14. Meglitsch P. A. & Schram, F. R. 1991. Invertebrate Zoology. Oxford Univ. Press.
15. Miller, S. A. & Harley, J. P. 2006. Zoology, 7th Edition. McGraw Hill International.
16. Moore, Janet. 2006. An Introduction to the Invertebrates. Cambridge University Press.
17. Pechenik, J. A. 2005. Biology of the Invertebrates. Tata McGraw Hill Publ.
18. Ruppert, E.E. & Barnes, R.D.1994, Invertebrate Zoology. Harcourt Asia Pvt. Ltd.
19. Ruppert, E. E., Fox, R. S. & Barnes, R. D. 2009. Invertebrate Zoology: A Functional Evolutionary Approach. 7<sup>th</sup> edition. Thomson Brooks/Cole.
20. Hyman, L.H. : The Invertebrates Vol. I-VI, McGraw-Hill, New York

# Far-Western University

## Faculty of Science and Technology

Course No.: **Zoo 111**

Credit: 1

Nature of the Course: **Practical**

No. periods/ week:

Year: **First**,

Semester: **First**

Level: **B. Sc.**

### 1. Course Description

This is practical course for B. Sc. first semester. The course intends to enable the students to be acquainted with basic concepts of systematic, classification schemes, histology and anatomy of lower non-chordates.

### 2. Course Objectives:

The general objectives of the courses are as follows.

- Identify the important representatives of lower non-chordate phyla.
- Know the histology different organs of lower non-chordates non-chordates.
- Learn general anatomy of different animals.

### 3. Course Contents

#### 3. 1. Animal Diversity

Study of salient features and classification up to classes of the lower non-chordates with special emphasis on their adaptive characters: Study the typical representative of animals types either on slide or the specimens.

#### Levels of organization in Animal kingdom

- Symmetry:    i) Asymmetric organization: *Amoeba*  
                  ii) Radial symmetry: Sea anemone, *Aurelia*  
                  iii) Bilateral symmetry: Planaria / liver fluke
- Coelome        i) Acoelomate: T.S. of Planaria / liver fluke  
                  ii) Pseudocoelomate: T.S. of *Ascaris*  
                  iii) Coelomate : T.S. of Earthworm
- Segmentation i) Pseudosegmentation: Tapeworm  
                  ii) Metamerism: Earthworm

**Culture of Protozoa.** Any type (few)

Study of transverse sections/chart of the following:

*Sycon*- as an example of Parazoa to show its structure, spicules and canal system,

*Hydra*- as an example of diploblastic animal,

*Fasciola*- as an example of triploblastic acoelomate animal,

*Ascaris*- as an example of triploblastic pseudocoelomate animal,

*Hirudinaria*- as an example of triploblastic schizocoelomate animal

#### **Study of Permanent (Histological) slides.**

Slides of *Vorticella*, *Leishmania*, *Obelia* with larval stages, *Fasciola* with its sections and larval stages, *Taenia* with its sections and larval stages, *Ascaris* - sections, *Hirudo*- sections,

**3.6 Permanent Mounting (Permanent Slide Preparations).** Any cultured Protozoa; *Daphnia*, *Cyclops*, *Cypris*, Spicules and Spongin fibres of Sponge, Nephridium, Salivary glands and jaws of *Hirudinaria*.

**3.7. Dissection.** Leech and Earthworms – General Anatomy, Digestive, Excretory, Nervous and Reproductive systems.

#### **4. Scheme of Evaluation**

This evaluation procedure consists of practical examination at the end of semester. The distribution of Marks for Practical Examination will be as follows.

Dissection = **35 %**

Temporary mount = **10 %**

Spotting of museum specimens/slides = **20 %**

Report writing on field visit/collections/preparations = **15 %**.

Viva voce = **10 %**

Class records = **10 %**

#### **5. Recommended books**

Verma, P.S. : A Manual of Practical Invertebrate Zoology, S. Chand and Co., India.

Lal, S.S. : A Text Book of Practical Zoology : Invertebrate.

**FAR WESTERN UNIVERSITY**  
**Faculty of Science and Technology**

Course Title: **Basic Chemistry I**  
 Course No.: **CHM111**  
 Nature of Course: **Theory**  
 Level: **B. Sc.**  
 Year: **First, Semester: First**

F.M.: 100  
 P.M.: 45%  
 Credit: 3  
 Number of hours per week: 3  
 Teaching Hours: 45

**(1). Course Description**

The course intends to enable the students to be acquainted with the basic concepts of chemistry, in all three branches physical, organic and inorganic chemistry. Students will be familiarized with the fundamentals of chemistry of states of matter, atomic structure, periodic table and the hydrocarbons.

**(2). Course Objectives:**

The general objectives of the course are as follows:

- To acquaint the students with basic concepts of the chemistry of gaseous, liquid and solid states.
- To enable the students to understand the fundamentals of the elements, atomic structure, the periodic table and the periodic properties.
- To enable the students to understand the basic chemistry of hydrocarbons.
- To enable the students to appreciate the importance of chemistry in day to day life and value the scientific method of chemical research and investigation.

**(3). Specific Objectives and Contents:**

<b>Specific Objectives</b>	<b>Physical Chemistry Contents</b>
<ul style="list-style-type: none"> <li>● Explain the differences between ideal and real gases.</li> <li>● Describe the postulate of Kinetic theory of ideal gases.</li> <li>● Derive important Gas Laws based on kinetic gas equation.</li> <li>● Discuss the basic concepts of velocity of gas molecules.</li> <li>● Describe different types of the speed of gases as well as the collision parameters.</li> <li>● Discuss the reason behind the deviation of ideal behaviour of the gas.</li> <li>● Derive Van der Waals equation.</li> <li>● Describe critical phenomena of the gases.</li> <li>● Introduce the concept of liquefaction of gases.</li> <li>● Enable the learners to acquire skill of solving numerical problems related to all gas laws.</li> </ul>	<p><b>Unit I: Gaseous State (8)</b>            Ideal and real gases; Ideal gas equation; The gas constant; The Kinetic theory of ideal gases; The Kinetic gas equation; Deduction of the gas laws based on kinetic gas equation (Boyle's law, Charles's law, Avogadro's principle, Graham's law of diffusion, Dalton's law); The velocity of gas molecules; Root mean square velocity; Average velocity; Most probable velocity; Average kinetic energy of gas molecules; Molecular interpretation of the temperature.            The Maxwell-Boltzmann distribution; Maxwell distribution of speeds; Types of average speeds; Pressure of an ideal gas; Collision of hard-sphere molecule (collision diameter, collision frequency, mean free path, collision density); Deviation of real gas from ideal behaviour; Causes of deviations; Derivation of Van der Waals equation; Explanation of behaviour of real gas from Van der Waals equation; Other equations of state; The Virial equation; Boyle's temperature and Van der Waals constants, Critical phenomenon; Relation between Van der Waals constant and critical constants.            Liquefaction of gases (Linde and Claude processes); Refrigerator; Liquefaction of air.</p>
<ul style="list-style-type: none"> <li>● Describe the molecular arrangement of the liquid.</li> <li>● Discuss the different characteristics of liquid state such as density, diffusion, viscosity, surface tension, evaporation, boiling point, vapour pressure.</li> <li>● Explain the methods of determination of viscosity and surface tension.</li> <li>● Discuss the applications of surface tension and viscosity.</li> </ul>	<p><b>Unit II: Liquid State (3)</b>            Liquid (classification and molecular arrangement); Liquid state (density, diffusion, viscosity, surface tension, evaporation, boiling point, vapour pressure); Determination of viscosity and surface tension; Applications of surface tension and viscosity.</p>
<ul style="list-style-type: none"> <li>● Explain the difference between crystalline and amorphous solids.</li> <li>● Explain the structure and properties of (metals, ionic crystals, covalent crystals</li> </ul>	<p><b>Unit III: Solid State (4)</b>            Classification (Crystalline and amorphous solids); Types of solids (metals, ionic crystals, covalent crystals, Van der Waals crystals) and their properties; Crystal structure; Unit cells and crystal systems; Bravais lattices; Cubic</p>

<p>and Van der Waals crystals.</p> <ul style="list-style-type: none"> <li>Define and describe unit cells and crystal systems.</li> <li>Illustrate and explain different types of cubic crystals.</li> <li>Explain Bravais lattices and Miller indices.</li> </ul>	<p>crystals (simple, body centered and face centered cubic crystals); Miller indices.</p>
<b>Organic Chemistry</b>	
<ul style="list-style-type: none"> <li>Explain the structures of alkanes and alkane isomers.</li> <li>Explain IUPAC system of naming alkanes.</li> <li>Describe the properties of alkanes.</li> <li>Define the term conformation and discuss conformational analysis of the alkanes.</li> <li>Explain the structure, IUPAC nomenclature and geometrical isomerism of cycloalkanes.</li> <li>Discuss the factors affecting the stability of cycloalkanes.</li> <li>Discuss the conformational analysis of cycloalkanes including mono- and disubstituted cyclohexanes and polycyclic molecules.</li> </ul>	<p><b>Unit IV: Alkanes (5)</b> Alkanes and alkane isomers; Alkyl groups; Nomenclature of alkanes; Properties of alkanes; Conformations of ethane; Conformations of other alkanes; Cycloalkanes; Nomenclature of cycloalkanes; Cis-Trans isomerism in cycloalkanes; Stability of cycloalkanes; Conformations of cycloalkanes (cyclopropane, cyclobutane, cyclopentane and cyclohexane); Axial and equatorial bonds; Conformations of mono- and disubstituted cyclohexanes; Conformations of polycyclic molecules.</p>
<ul style="list-style-type: none"> <li>Explain the structure, industrial preparation, uses, IUPAC nomenclature and geometrical isomerism of alkenes.</li> <li>Discuss the Sequence Rule of E, Z designation.</li> <li>Discuss the electrophilic addition reactions of alkenes in terms of mechanism and orientation.</li> <li>Introduce the Hammond postulate and highlight its importance.</li> <li>Explain different types of preparation and reactions of the alkenes.</li> </ul>	<p><b>Unit V: Alkenes (6)</b> Alkenes; Industrial preparation and uses of alkenes; Calculation of degree of unsaturation; Nomenclature of alkenes; Cis-Trans isomerism; The Sequence Rule (the E,Z designation); Stability of alkenes, Electrophilic addition reactions; Orientation of electrophilic addition reactions (Markovnikov's rule); Carbocation structure and stability; The Hammond postulate; Evidence for the mechanism of electrophilic addition reaction. Preparation of alkenes; Addition of halogens to alkenes; addition of hypohalous acids to alkenes; Addition of water to alkenes (Oxymercuration and Hydroboration reactions); addition of carbenes to alkenes; Reduction of alkenes; Oxidation of alkenes (Epoxidation, Hydroxylation and Cleavage to Carbonyl Compounds); Radical additions to alkenes; Biological addition of radicals to alkenes.</p>
<ul style="list-style-type: none"> <li>Explain the structure and IUPAC nomenclature of alkynes.</li> <li>Explain different types of preparation and reactions of the alkynes.</li> <li>Introduce the role of alkynes in organic synthesis.</li> </ul>	<p><b>Unit VI: Alkynes (4)</b> Alkynes; Nomenclature of alkynes; Preparation of alkynes; Reactions of alkynes (Addition of HX and X<sub>2</sub>); Hydration of alkynes; Hydroboration/Oxidation of alkynes; Oxidative cleavage of alkynes; Alkyne acidity and formation of acetylide anions; Alkylation of acetylide anions; Introduction to organic synthesis.</p>
<b>Inorganic Chemistry</b>	
<ul style="list-style-type: none"> <li>Explain the Bohr model of atom and its subsequent refinement.</li> <li>Explain wave mechanical model of atom.</li> <li>Enable the students to write electronic configuration of atoms.</li> <li>Introduce the students with fundamentals of nuclear chemistry.</li> <li>Explain the periodic law and the periodic table.</li> <li>Discuss the periodic trend in the periodic table.</li> <li>Describe the occurrence and principle</li> </ul>	<p><b>Unit VII: Atomic Structure, Periodic Table and Elements (15)</b> Electronic structure of the atom; Bohr theory; Improvement on Bohr theory; Wave mechanics; de Broglie's equation; Heisenberg's uncertainty principle; Schrodinger's wave equation (time independent); Physical significance of wave function, Normalization of wave function; Probability; Density pattern for hydrogen atom; Radial and angular wave functions; Radial distribution curves; Atomic orbitals in wave mechanics; Orbitals (s, p, d, f orbitals); Charge cloud diagrams and boundary surface diagrams; Nodal planes; Quantum numbers and their significance; Energy levels in the hydrogen atom; Structure of atoms with many electrons; Radial penetration of the wave functions; The Aufbau principle; Hund's rule; The Pauli exclusion principle; Electronic configuration. The nucleus; Subatomic particles; Nuclear stability; Binding energy;</p>



behind different methods of extraction and purification of metals from its ore.	Radioactivity; Natural and induced radioactivity; Half-life determination and nuclear reactions; Radioactive displacement law and radioactivity series. Periodicity of elements; The periodic law and arrangement of elements in the periodic table; IUPAC system of Periodic Table; s, p, d and f blocks; Long form of Periodic Table; General properties of atoms- size of atoms and ions- atomic radii; Ionic radii; Covalent radii; Trends in ionic radii, ionization potential, electron affinity; Electronegativity (Pauling, Mulliken, Alfred-Rochow definition); Oxidation states and variable valency; Isoelectronic relationship; Standard reduction potentials; Electrochemical series. The occurrence and isolation of elements, Factors influencing the choice of extraction process, Mineral beneficiation-pretreatment, Dense medium separation, Flotation process, Solution methods, Magnetic separation, Electrostatic precipitation, Thermal decomposition methods, Displacement of one metal by another, High temperature chemical reduction methods, Reduction by carbon, Reduction by metal, Self-reduction, Reduction of oxides by hydrogen, Electrolytic reduction in aqueous, non-aqueous and fused melts, Thermodynamics of reduction process-Ellingham diagram.
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#### (4). Evaluation System

Undergraduate Programs							
External Evaluation	Marks	Internal Evaluation	Weight age	Marks	Viva-voce	Weight age	Mark
End semester examination	60	Assignments	20%	20	Report and Presentation on any topic	50%	20
(Details are given in the separate table at the end)		Quizzes	10%		Presentation	25%	
		Attendance	20%		Viva	25%	
		Internal Exams	50%				
Total External	60	Total Internal	100%	20		100%	20
Full Marks 60+20+20 = 100							

#### (I). External evaluation:

##### End semester examination:

It is a written examination at the end of the semester. The questions will be asked covering all the units of the course.

##### External Evaluation (Viva):

After completing the end semester theoretical examination, viva examination will be held. External examiner will evaluate report/presentation & take viva exam and will do above mentioned evaluation. Students should make a small report by relating any of the studied topics in the subject to some application areas/examples. Reports can be made in groups. There will be an internal examiner to assist the external examiner. In this examination Students must demonstrate the knowledge of the subject matter.

Each student must secure at least 50% marks in internal evaluation in order to appear in the end semester examination. Failed student will not be eligible to appear in the end semester examinations.

#### (II). Internal evaluation

**Assignment:** Each student must submit the assignment individually. The stipulated time for submission of the assignment will be seriously taken.

**Quizzes:** Unannounced and announced quizzes/tests will be taken by the respective subject teachers. Such quizzes/tests will be conducted twice per semester. The students will be evaluated accordingly.

**Attendance in class:** Students should regularly attend and participate in class discussion. Eighty percent class attendance is mandatory for the students to enable them to appear in the end semester examination. Below 80% attendance in the class will signify NOT QUALIFIED (NQ) to attend the end semester examination.

**Presentation:** Students will be divided into groups and each group will be provided with a topic for presentation. It will be evaluated individually as well as group-wise. Individual students have to make presentations on the given topics.

**Mid-term examination:** It is a written examination and the questions will be asked covering all the topics in the session of the course.

**Discussion and participation:** Students will be evaluated on the basis of their active participation in the classroom

discussions.

**Instructional Techniques:** All topics are discussed with emphasis on real-world application. List of instructional techniques is as follows:

- Lecture and Discussion
- Group work and Individual work
- Assignments
- Presentation by Students
- Quizzes
- Guest Lecture

Students are advised to attend all the classes and complete all the assignments within the specified time period. If a student does not attend the class(es), it is his/her sole responsibility to cover the topic(s) taught during that period. If a student fails to attend a formal exam/quiz/test, there won't be any provision for re-exam.

**(5). Prescribed Texts:**

1. S. H. Maron, C. Prutton, **Principles of Physical Chemistry**, Oxford and IBH Publication and Co., 1992.
2. John Mc Murry, **Introduction to Organic Chemistry**, Brookes/Cole, 2007.
3. J.D. Lee, **Concise Inorganic Chemistry**, 5<sup>th</sup> Edition, John Wiley and sons. Inc., 2007.

**(6). Reference**

4. F. Daniels, R. F. Alberty, **Physical Chemistry**, John Wiley & Sons, Latest Edition.
5. Gilbert. W. Castellan, **Physical Chemistry**, Narosa Publishing House, 1985.
6. R. T. Morrison, R. N. Boyd, **Organic Chemistry**, Prentice- Hall of India Pvt. Ltd., 2008.
7. J. S. H. Pine, **Organic Chemistry**, McGraw Hill International Edition Series, New York, USA, 1987.
8. F.A. Cotton, G. Wilkinson, C. Gaus, **Basic Inorganic Chemistry**, John Wiley & Sons (Asia) Pvt. Ltd., 2007.
9. D. F. Shriver, P. W. Atkins, **Inorganic Chemistry**, W. H. Freeman and Co., London, 1999.
10. B. R. Puri, L. R. Sharma , K. C. Kalia, **Principles of Inorganic Chemistry**, Shoban Lal Nagin Chand and Co., Delhi, India, 1996.

**FAR WESTERN UNIVERSITY**  
**Faculty of Science and Technology**

Course Title: Chemistry Lab I  
Course No.: CHM111  
Nature of Course: Practical  
Level: B. Sc.  
Year: First, Semester: First

Credit: 1  
Number of hours per week: 3

**(1). Course Description**

The course intends to enable the students to be skilful in the basic chemical laboratory techniques. Students will be introduced to scientific method of experimentation. Students will develop skill on performing an experiment, observing and recording results and judiciously interpreting the results.

**(2). Course Objectives**

The general objectives of the course are as follows:

- To enable students to perform experiments on liquid properties of matter.
- To enable the students to develop basic analytical skill on organic qualitative analysis.
- To enable the students to develop basic analytical skill on inorganic qualitative analysis.

**(3). Specific Objectives and Contents**

Specific Objectives	Contents
<ul style="list-style-type: none"><li>● Enable the students to undertake experiments on surface tension and viscosity and interpret the results obtained.</li><li>● Enable the students to perform an experiment on Rast method to determine the molecular weight of an organic compound.</li><li>● Enable the students to perform experiments on boiling point determination and melting/ mixed melting point determination.</li><li>● Enable the students to perform experiments on foreign elements detection and test for aliphatic and aromatic nature in organic compounds.</li><li>● Enable the students to purify organic compounds by means of crystallization, distillation, sublimation and filtration.</li><li>● Enable the students to determine the functional groups according to the solubility of the compounds.</li><li>● Enable the students to calibrate the volumetric kits and prepare standard solutions</li><li>● Enable the students to perform experiments on acid- base and redox titrations.</li></ul>	<p><b>Physical Chemistry Content</b></p> <ol style="list-style-type: none"><li>1. Determination of surface tensions of two liquids supplied with the help of a Stalagnometer and interpret the result.</li><li>2. Determination of the viscosity of two liquids with the help of a Ostwald's viscometer and interpret the result.</li></ol> <p><b>Organic Chemistry Content</b></p> <ol style="list-style-type: none"><li>1. Determination of melting and boiling points of organic compounds.</li><li>2. Determination of mixed melting point.</li><li>3. Detection of N, S and halogens.</li><li>4. Test for aliphatic and aromatic nature of organic compounds</li><li>5. Purification of organic compounds by crystallization, distillation, sublimation and filtration.</li><li>6. Determination of functional groups present in organic compounds based on solubility.</li></ol> <p><b>Inorganic Chemistry Content</b></p> <ol style="list-style-type: none"><li>1. Calibration of volumetric kits: burette, pipette and standard flasks.</li><li>2. Preparation of Standard solutions.</li><li>3. Experiment on acid – base titrations;<ol style="list-style-type: none"><li>a. Estimation of HCl.</li><li>b. Estimation of oxalic acid.</li><li>c. Estimation of total alkalinity in a sample of water.</li></ol></li></ol> <p><b>Experiments on redox titrations</b></p> <ol style="list-style-type: none"><li>a. Estimation of ferrous ammonium sulphate (permagnometry)</li><li>b. Estimation of calcium (permagnometry)</li><li>c. Estimation of <math>\text{KMnO}_4</math> (iodometry)</li></ol>

**(4). Textbooks and Reference Books**

- David P. Shoemaker, Carl W. Garland, Joseph W. Nibler, **Experiments in Physical Chemistry**, 5<sup>th</sup> edition, McGraw-Hill Book Company, **1989**. (Latest Edition).
- B. P. Levitt, ed. **Findlay's Practical Physical Chemistry**, Longman, London, **1973**. (Latest Edition)

- J. N. Gurtu, R. Kapoor, **Advanced Experimental Chemistry** (Vol I – III), S. Chand and Co., New Delhi, India, **1989**. (Latest edition).
- B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchel, **Vogel's Text Book of Practical Organic Chemistry**, 5th Edition, Person Education, **2005**.
- L. Shriner, R. C. Fuson, D. Y. Curtin, **The Systematic Identification of Organic Compounds, A Laboratory Manual**, John Wiley and Sons Inc, New York, USA , **1980**. (Latest Edition).
- N. S. Gnanaprasadam, G. Ramamurthy, **Organic Chemistry – Lab Manual**, S. Viswanathan Co., Pvt., India, **1998**.
- **Vogel's Text Book of Inorganic Qualitative Analyses**, 4<sup>th</sup> Edition, ELBS, London, **1974**. (Latest Edition).
- Moti Kaji Sthapit, R. R. Pradhananga, **Experimental Physical Chemistry**, Taleju Prakasan, Kathmandu, Nepal, **1998**.
- K. N. Ghimire, M. R. Pokhrel K. P. Bohara, **University Experimental Inorganic Chemistry**, Quest Publication, Kirtipur, Kathmandu, Nepal, **2008**.