

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



B. Sc. Third Semester Biology Group

Far Western University

Faculty of Science and Technology

Course Title: Environmental Earth Science and Applications Course No.: ENV231

Nature of the Course: Theory Level: B. Sc (Undergraduate)

Year: Second Semester: Third

Total Credit: 3

Instruction hours/week: 3

1. Course Description

The aim of the course is to provide comprehensive knowledge on Earth resources, geological processes, make the students familiar with concepts of environmental geology, and developing the analytical skills of environmental survey. The course has been divided into four units.

2. Course Objectives

The objectives of the course are as follows:

- To enrich students understanding on basic concept of earth resources and geological processes.
- To enhance students understanding on broader aspects of environmental Science linking Geology and geological consideration.
- To make students familiar with scope and application of Environmental Survey.
- To familiarize the students with soil and its role.
- To enhance the knowledge of students on depositional landforms of wind and water.

3. Specific Objectives and Contents

Specific Objectives	Contents
<ul style="list-style-type: none">● Provide basic concept and of Atmosphere, lithosphere and hydrosphere and their association.● Enhance students' knowledge on Earth materials and their implications.● Describe on Earth's Exogenic and endogenic processes.	Unit 1: Earth Resources 8 hrs Atmosphere; lithosphere; hydrosphere; interior of Earth; Earth Materials (Rocks and minerals): rock cycle, rock types, minerals and types, mineral resources of Nepal; Earth Processes: Endogenic and Exogenic; Tectonism; Volcanism.
<ul style="list-style-type: none">● Provide Knowledge on weathering, erosion and its types.● Discuss about physio -Chemical and biological properties of soil.	Unit-2: Geological Surface processes and Environment 15 hrs Geological surface processes : Weathering and erosion: types, Characteristics, factors; Erosion cycle;

<ul style="list-style-type: none"> ● Explain about soil profile, its formation and soil types of Nepal. ● Provide knowledge on Geological work of wind and Water. ● Describe about Mass movements, their causes and types. ● Discuss about erosional land forms and depositional land forms of fluvial environment. 	<p>Soil: Concept and relation with environment; Process and factors affecting soil genesis; Chemical and mineralogical composition of soil; Properties of soil: Physical, chemical and biological; Humus: Nature, properties and formation Soil profile and types; Soil types of Nepal; Soil erosion and control.</p> <p>Geological work of wind and Water; Mass movements: types; Fluvial environment: Types of Drainage pattern; Channel pattern, Erosional landforms; Fluvial deposits; Flood plain and river terraces.</p>
<ul style="list-style-type: none"> ● Discuss about broader aspects of environmental Science linking Geology and geological consideration. ● Explain about the Land use, land use planning and policy of Nepal. ● Explain about Geological criteria and decision making for waste disposal and infrastructural development. ● Discuss about Physiographic, geomorphic and tectonic division of Nepal Himalaya. ● Provide Knowledge on major hazards associated with physiographic zones of Nepal and mitigation measures. 	<p>Unit 3: Environmental Geology 15 hrs</p> <p>Environmental Geology: concept and its application; Anthropogenic activities and Geology: Land degradation and soil erosion; Land Use: Land use planning; Land use policy of Nepal; Land use patterns in Nepal; Geological criteria of land use planning and decision making for waste disposal and infrastructural developments: roads, tunnels, bridges and foundation, Dams and reservoirs; Geotechnical consideration and environmental impacts; Land capability mapping; Instability of hill slopes and landslides; Case studies; Geological aspects of environmental health; Physiographic, geomorphic and tectonic division of Nepal Himalaya and major hazards associated with these zones, mitigation measures.</p>
	<p>Unit4 - Geo -Environmental Skills 15 hrs</p>

<ul style="list-style-type: none"> ● Provide knowledge on concept, scope and importance of environmental survey. ● Discuss about different types of maps and their interpretation. ● Describe Topographic surveying and their methods. ● Enhance students' knowledge on contour map preparation and locating contours. ● Explain about Concept and application of Remote Sensing (RS) and Geographic Information System (GIS) ● Explain the use of GPS in relation to environmental monitoring. 	<p>Environmental survey: Definition and concept, objective, importance and scope; Introduction and types of map; Topographic surveying: Concepts, inventory and mapping, methods of topographic surveying, methods of representing relief;</p> <p>Contours: concepts and characteristics, methods of locating and interpolation; Concept and application of Remote Sensing (RS), Geographic Information System (GIS), Global Positioning System (GPS) in relation to environmental monitoring; Methods of resources surveying: land, water, forest, mines.</p>
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References:

1. Adoni , A. D. A text book of Limnology, Prathiba Publishers, Sagar India.
2. Agrawal K.M. Sikdar P.K. Deb, S.c. .A text book of Environment, Macmillan India Limited.
3. Avery, T.E. and Berlin, G.L. 1992, Fundamentals of Remote Sensing and Air Photo Interpretation, Macmillan.
4. Bloom, A.L. 1992, Geomorphology, Prentice Hall Pvt. Ltd, New Delhi.
5. Brady, N. C. and well R.R, (2007). The Nature and properties of Soils, Pearson Prentice Hall, New Delhi.
6. Critchfield, H.J. *General Climatology* Prentice Hall Pvt. Ltd, New Delhi.
7. Cunningham, W.P and Cunningham, M.A. (2004). Principles of environmental Science: Inquiry and Applications 2nd edition .MC Grawhill, Boston.
8. Joseph , G. , 2005, Fundamentals of Remote Sensing, University Press (India) Pvt. Ltd, Hyderabad.
9. Keller ,E.A. (1985) Environmental Geology, Charles E. Merrill publishing company, Bell and Howell company, columbus, Ohio.
10. Mahapatra, G. B., (2008).Text Book of Physical Geology, CBS Publishers and Distributers, India.
11. Punmia, B.c, Jain A.k. (2005), Surveying Vol. I , Surveying Vol. II, 16 th publication.Laxmi PublicationsP. Ltd, New Delhi.
12. Reineck, H.E and Barrett, G. W. (1990).Depositional Sedimentary Environments with reference to Rerrigeneous Clastics. Pringer Verlag, Berlin Heidelberg.
13. Singh, s. Geomorphology
14. Valdiya, K.S. (1987) Environmental Geology, Ist edition, Tata MC Grawhill Limited, New Delhi.

Far Western University
Faculty of Science and Technology

Course Title: Environmental Earth Science Course No: -Env 231

Year: Second Semester: Third

Nature of Course: Practical

Total Credit: 1

1. Study of basic components of topographic map and interpretation for geo-environmental study.
2. Study of geological maps and describing its geological features.
3. Identification and study of Rocks (Igneous, sedimentary and metamorphic) and common minerals in hand on specimen.
4. Rock mass classification
5. Study of soil profile: recording profile, sampling of soil and laboratory study of soil samples, grain size analysis.
6. Handling and application of geological compass.
7. Preparation of contour maps and Drainage patterns.
8. Study on survey tools, techniques.
9. Study on map reading techniques and GPS tracking method.

Some major points related to aforementioned practical:

1. Students have to carry out *field visit* for supporting practical number **3,4,5, 6,8 and 9**. Since the field work is for complete academic purpose. For this purpose University will have to support students for necessary transportation cost.
2. Students have to prepare a field report of field visit and submit during practical examination.
3. Students have to submit a field note book of each field visits, during practical examination.

Instructional Techniques in Environmental Science

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/Project work/Field work/Work shop/Seminar/internship
- Quizzes
- Field Visits and Demonstration

(More emphasis should be given in field visit)

Evaluation

This course is for one semester (15 weeks) which carries 100 percentage marks. The examination evaluation procedure consists of both internal examination and external examination. The weightage of these examinations are as follows:

Internal Evaluation: 40%

External Evaluation: 60%

a) Internal Evaluation:

This is a continuous evaluation process which carries 40 % weightage. Assuming it as 100%, the bases of Internal Evaluation will be as follows:

- | | |
|-----------------------------|-----|
| 1. Assignments | 20% |
| 2. Quizzes | 10% |
| 3. Semester(Mid Term) Exam: | 60% |
| 4. Attendance | 10% |

Attendance in Class: Students should regularly attend and participate in discussions in the class. 90% class attendance is mandatory for the students to enable them to appear in the End-Term examination. Below 80% in attendances that signify as NOT QUALIFIED (NQ) in subject to attend the end term examination.

Assignment: Each student must submit the assignment individually. The stipulated time for submission of the assignment will be seriously taken as one of the major criteria of the evaluation.

Mid-Term Examinations: It is a written examination and the questions will be set covering the topics as taught in the sessions. Mid-term examination will be based on the model prescribed for End-term examination.

b) End-Term/External Examinations: It is also a written examination and the questions will be set covering all the topics in the session of the course.

Strict Notice for students : Each student must secure% marks with 80% attendance in internal evaluation in order to qualify the End-Term Examinations. Failing to get such score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear in the End-Term examinations.

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Model of Subject Combination chart with Environmental Science for both Biological and Physical Science group students.

1) For physical Science group students

Semester		Course Code	Course Title	Credit Hour		Total Credits
				Th.	Prac.	
First	Major subjects for physical Science group	Phy-	Physics	3	1	19
		Env	Environmental Science	3	1	
		MTH-	Mathematics	4		
	Compulsory subjects	ENG-	English	3		
		Comp	Computer	3	1	

1) For Biological Science group students

Semester		Course Code	Course Title	Credit Hour		Total Credits
				Th.	Prac.	
First	Major subjects for Biological Science group	Env.	Environmental Science	3	1	19
		Chem-	Chemistry	3	1	
		Zol-	Zoology	3	1	
	Compulsory subjects	ENG-	English	3		
		Comp-	Computer	3	1	

Note: There are two compulsory subjects. The compulsory subjects will change in each semester according to university curriculum under faculty of science and technology and students will take three major subjects from semester first up to semester Sixth. And in the Seventh and Eighth Semester, student will have to choose any two major subjects (among three) of Sixth semester.

Detail Framework of Proposed Course Structure of Environmental Science

Semester	Course Number	Course Title	Credits	Total Credits
I	Env	Fundamentals of Environmental Science	3	4
	Env	Practical: based on Env.	1	

II	Env	Environmental aspects of Meteorology , Hydrology and Geology	3	4
	Env	Practical based on Env.	1	
III	Env	Environmental Pollution and Pollution control technologies	3	4
	Env	Practical based on Env.	1	
IV	Env	Environmental Computations (Applied Statistics)	3	4
	Env	Practical based on Env.	1	
V	Env	Introductory Environmental engineering	3	8
	Env	Practical based on Env.	1	
	Env	Natural Resource Management	3	
	Env	Practical based on Env.	1	
VI	Env	Climate Change and ecosystem management	3	8
	Env	Practical based on Env.	1	
	Env	Energy and Environment	3	
	Env	Practical based on Env.	1	
VII	Env.	Urbanization and Sustainable Development	3	8
	Env.	Practical based on Env.	1	
	Env.	Environmental Hazards and Disaster Risk Management	3	
	Env.	Practical based on Env.	1	
VIII	Env.	Environmental Assessment and Project management	3	12
	Env.	Practical based on Env. (EMS, RS, GIS & EIA/SIA, ISO certification, IEMS)	1	
	Env.	Environmental Sociology, Environmental Governance and Administration(Principles and Practices)	3	
	Env.	Internship on Environmental Organizations	1	

	Env.	Project work , field work and Seminar (Research Oriented)	4	
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Far-Western University
Faculty of Science and Technology

Course Title: **Molecular Biology**

Credit: **3**

Nature of the Course: **Theory**

Total hours: **45**

Course No.: **MIB 231**

Semester: **Third**

Level: **B. Sc.**

Year: **Second**

1. Course Description

A central goal of this course understands about genes, their structure and function. Therefore, students will study nucleic acid structure and the mechanics of replication, repair, transcription, translation, gene expression and regulation in bacteria and eukaryotes. Critical experiments will be examined to learn how our current understandings have come about. Techniques in molecular biology will be examined in lecture as necessary to understand experiments and concepts. The aim of the course is to provide fundamental knowledge of understanding of microbial genetics, genetic engineering and application of genetic engineering.

2. Course Objectives

At the end of Molecular Biology 231, a student should be able to:

- Explain the mechanisms of DNA replication, repair, recombination, transcription, gene expression and gene regulation, RNA processing and translation in bacteria & eukaryotes.
- Compare and contrast the mechanisms of bacterial and eukaryotic DNA replication, DNA repair, transcription, and translation.
- Explanation of microbial genetics.
- Basic concept and principle of genetic engineering and recombinant technology.
- Describe the techniques of molecular biology, Identify the significance of molecular biology.
- Familiar to molecular biology techniques that are used to isolate, separate, amplify, transfer and sequencing of specific nucleic acids and gene.

Unit I: DNA replication

5

Prokaryotic DNA Replication:

An introduction experimental proof of DNA and RNA are genetic material, Central dogma of molecular biology, Chemistry of DNA synthesis, General principles: bidirectional replication, Conservative, Semi-conservative and dispersive. RNA priming, various models of DNA replication: rolling circle, D-loop (mitochondrial), Θ (theta) mode of replication, replication of linear ds-DNA. Enzyme involved in DNA replication: DNA polymerases, DNA ligase, primase, telomerase and other accessory proteins. Fidelity of replication, Replication errors, DNA damage and their repair, Applications of mitochondrial DNA.

Genetic Recombination between homologous DNA sequences:

Types of Recombination: The Holliday Model, The Asymmetric Strand Transfer Model, The recBC Protein.

Unit II: Prokaryotic Transcription **3**

RNA polymerase and the transcription unit, Transcription in prokaryotes, Salient differences between prokaryotic and eukaryotic transcription. Overview of gene expression and gene regulation, Processing of mature mRNA: 5' and 3' modifications. Splicing mechanisms, Splicing of tRNA precursors, Splicing of rRNA precursors, Splicing without a protein enzyme, RNA editing.

Unit III: Prokaryotic Translation **5**

Assembly line of polypeptide synthesis: ribosome structure and assembly, various steps in protein synthesis. Charging of tRNA, aminoacyl tRNA synthetases. Proteins involved in initiation, elongation and termination of polypeptides. Fidelity of translation. Inhibitors of protein synthesis, Post translational modifications, Protein sorting Protein Stability.

Unit IV: Mutation and mutagenesis **4**

Occurrence, Kinds of mutation, Spontaneous & induced mutation, Mutagens, Detection of Mutation, Lethal mutations, Biochemical mutations, Phenotypic effects of mutation, Molecular basis of mutation, Significance & practical applications of mutation.

Molecular basis mutagenesis and various types of mutagenesis.

Unit V: Bacterial Plasmids **4**

Structure and properties of plasmids, Types of plasmids, Plasmid replication and incompatibility, Amplification and curing of plasmid.

Unit VI: Bacteriophage Genetics **4**

Benzer's fine structure of gene in bacteriophage T4, Plaque Formation and Phage mutants, Genetic recombination in the lytic cycle, concept of recon, muton, cistron.

Unit VII: Genetic Engineering and Recombinant DNA **8**

The Isolation of DNA, Biology of restriction enzymes, Cutting DNA with restriction enzymes, Isolation of DNA fragments, Joining DNA fragments,

Vectors: Selection and Autonomous DNA Replication, Plasmid Vectors, A Phage Vector for Bacteria, cosmid, phagemid, PACs, BACs, YACs, Expression vectors, Putting DNA Back into Cells, Cloning from RNA, Plaque and colony hybridization for clone Identification, Walking Along a chromosome to clone a gene, Arrest of translation to assay for DNA of a gene.

DNA Sequencing: Chemical DNA Sequencing, Sanger's method, Maxman and Gilbert Method, Human genome sequencing project.

Unit VIII: Basic Molecular Biology Techniques **8**

Expression of cloned genes, Polymerase chain reaction, Agarose gel electrophoresis,

Nucleic acid hybridisation, Restriction fragment length polymorphism analysis, Single nucleotide polymorphisms, Southern blot, Northern blot, DNA Fingerprinting, *Agrobacterium* and gene transformation, Isolation and separation of protein by Electrophoresis.

Journal Club Perspective Papers

4

During these journal clubs, we will focus on review of the research article of Molecular Biology published last two years. Data will be collected and presented in the figures and tables, and small groups will be asked to present figures from the paper. In addition, for each paper, Students will be asked to write a short perspective describing the main findings of the paper and evaluating the research. Instructions for these writing assignments will be distributed in class.

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.

Strict Notice: Each student must secure minimum of 80 % marks with 80% attendance in internal evaluation in order to qualify for the End-Term Examinations. Failing to get such score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear the End-Term examinations.

Far-Western University
Faculty of Science and Technology

Course Title: **Molecular Biology**

Credit: 1

Nature of the Course: **Practical**

Course No.: **MIB 231**

Semester: **Third**

Level: **B. Sc.**

Year: **Second**

- Perform Ames test in *Salmonella* / *E.coli* to study mutagenicity.
- Perform Replica plate technique to study mutagenicity.
- Isolation and separation of protein by Sodium dodecyl sulphate PAGE.
- Perform DNA amplification by PCR.
- Extraction of genomic DNA from plant source.
- Agarose gel electrophoresis of genomic DNA.
- Restriction digestion of plasmid DNA.
- Estimation of DNA by Diphenylamine method.
- Restriction enzyme digestion of genomic DNA from *E. coli*.
- Isolation of plasmid DNA and genomic DNA together from *E. coli*.
- Demonstration of DNA fingerprinting
- Visit to the sophisticated Molecular laboratory, Genetic laboratory, Biotechnology laboratory, Microbiology laboratory of Research Center or University

Reference Books for Molecular Microbiology

- Watson J. D., Baker, T. A ., *et al*(2008), ***Molecular Biology of the Gene***, 6th Edition, Cold Spring Harbor Laboratory Press, New York.
- Benjamin Lewin (2004), ***Gene VIII***, Published by Pearson Prints Hall, Pearson Education inc. Upper saddle River, New Jersey-07458
- Gardner E.J., Simmons, M.J., Snustad, D.P. (2008), ***Principles of Genetics***, 8th edition, Wiley India.
- Snustad D.P., Simmons, M.J. (2009), ***Principles of Genetics***, 5th Edition. John Wiley and Sons Inc.
- Stent S. G., M. Calender, R.(1986), ***Molecular Genetics: An Introductory Narrative***, 2nd Edition, CBS Publishers and Distributors, India.
- Elliott W.H., and D. C. Elliot, ***Biochemistry and Molecular Biology***, 4th edition, Oxford University press, New Delhi.
- Kith Wilson, John Walker, (2005), ***Principle and techniques in Biochemistry and Molecular Biology***, Cambridge University press.

<ul style="list-style-type: none"> ● Discuss about different types of natural resources, their status in Nepal. . ● Provide relevant information about natural resource consumption trend, their importance and future challenges. ● Highlight on concept of policy measures for different resources. 	<p>Unit 2: 20hrs</p> <p>Biodiversity Resources: Concept and levels, Status of Biodiversity in Nepal, Importance of Biodiversity, Types Threats, Uses of Biodiversity; Plant use, Medicinal and aromatic plants-Status and distribution in different ecological zones of Nepal. Current practices for Biodiversity management.</p> <p>Forest resources: status and distribution, major forest types of Nepal, Deforestation, Forest management and community forestry program in Nepal.</p> <p>Land resources: Land as a resource, land use pattern, land use classification, land degradation, man induced landslides, Land resource management (policy , planning and Practices)</p> <p>Water resources: State of water resource of Nepal, Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Sustainable Water resource management.</p> <p>Energy resources: Growing energy needs, renewable and non-renewable energy sources, Status and consumption trends of energy resources in Nepal, Use of alternate energy sources, Energy crisis: cause and consequences in Nepalese context; Case studies, Energy policy of Nepal.</p>
	<p>Food resources: World food problems, changes caused by agriculture and over-grazing,</p>
<ul style="list-style-type: none"> ● Familiarize the students with indigenous knowledge and their importance on NRM. 	<p>Unit 3: 10hrs</p> <p>Livelihoods and relation with Natural Resource Management:</p>

<ul style="list-style-type: none"> ● Highlight the importance of natural resource on livelihood. ● Familiarize students with global cross cutting issues: globalization, urbanization, climate change, and their impacts on natural resource. 	<p>Concepts and scope of livelihood, indigenous communities and traditional livelihoods, Forms of natural resources and dependencies of local people, natural resource crisis impacts on the livelihood of people, ecological, socio cultural and economic dimensions, threats of traditional livelihood from globalization, urbanization, privatization, and migration, climate change impacts, mitigation and adaptation practices in context of Nepal</p>
<ul style="list-style-type: none"> ● Explain the concept and meaning of natural resource governance. ● Describe characteristic features and components of governance system for NRM in Nepal. ● Describe on institutional, structural and legal frameworks. 	<p>Unit 4 6hrs</p> <p>Natural Resource Governance: Legal and political environments in resource management in context of Nepal. National and local governance, challenges of good governance in NRM, Institutional Frameworks of Nepal in NRM and livelihood. Natural Resource Governance in rapidly changing world.</p>
<ul style="list-style-type: none"> ● Describe about development of human civilization and their socio-cultural perspective regarding natural resources. ● Discuss the use of sociological and anthropological knowledge and practices on NRM. ● Describe the participatory technology development approach of NRM. 	<p>Unit 5: 4hrs</p> <p>Human Resource and Indigenous knowledge on Natural resource management</p> <p>Development of human Society and use of natural resources, Natural resources and community values, Concept of Indigenous Knowledge, Indigenous Knowledge practice in Nepal: Case studies, Participatory Technology development approach of NRM.</p>

Text Books:

- Francois Ramade 1984. Ecology of Natural Resources. John Wiley & Sons Ltd.
- Joshi KK, Joshi Sd, 2001, Genetic Heritage and medicinal and aromatic plants of Nepal Himalaya, Buddha Academics, Kathmandu.
- Klee, G.A. 1991. Conservation of Natural Resources. New Jersey: Prentice Hall Publ.Co.
- LehakHD,, Lekhak B. 2009, Natural resource conservation and sustainable development in Nepal, Khitiz publication, Kathmandu

References:

- GoN/MOFSC, 2014, Nepal Biodiversity Strategy and Action Plan 2014-2020, Government of Nepal, Ministry of Forest and Soil Conservation, Nepal.
- Khadka, N. B. 2008. Natural Resource and Conservation.
- Malhotra, KC and Prodyut Bhattacharya. 2010. Forest and Livelihood. Pub. Centre for

Economic and Social Studies. Hyderabad.

- Miller, G. T. (Jr.) and Spoolman, S. T. 2010. Living in the Environment. Brooks/Cole. Belmont, California, USA: Wards worth Publishing Company.
- MoE-GoN, (2010) National adaptation programme of action (NAPA) to climate Change, Ministry of Environment, GON.
- Nalini, K.S. 1993. Environmental Resources and Management. Anmol Publishers.
- NPC, 2011: Climate-Resilient Planning, Government of Nepal, National Planning Commission, Kathmandu, Nepal.
- Owen. O.S, Chiras. D.D, Reganold. J.P, 1998. Natural Resource Conservation Management for a Sustainable Future (7th Edition). Prentice Hall.
- Peter, M. Dixit, A. and Athukorala, K. (edited). 2007. Integrated Water Resources Management: Global Theory, Emerging Practice and Local need. Sage Publication
- Richard T. (2008). *Environmental Science, Toward a Sustainable Future*, PHI (P) Limited, India
- Sharma, V.K. 1985. Water Resources Planning and Management. Himalaya Pub. House
- Stainton, JDA. 1972. Forests of Nepal. John Murray, London.
- Weecs, 2010, Energy synopsis report, Water and Energy commission Secretariat, GON, Kathmandu.
- WECS. 1995. Alternative Energy Technology – Overview and Assessment, Kathmandu: WECS, GoN.
- WECS. 2011. Water Resources of Nepal in the Context of Climate Change. Water and Energy Commission Secretariat. GoN.

Far Western University
Faculty of Science and Technology

Course Title: Statistics and Probability

Credit: 3

Course No: STT231

Number of period per week: 4

Nature of the Course: Theory

Total hours: 45

Year: Second, Semester: Third

Level: B. Sc. General Science

1. Course Introduction

This course covers concept of descriptive statistics, probability, probability distributions, inferential statistics and their applications.

2. Objectives

At the end of this course the students should be able to:

- Know basic concepts of descriptive statistics, probability and their distributions, and inferential statistics and their applications in different areas.
- Identify existing pattern of data and their applications.
- Apply statistical tools and techniques in rational ways.
- Analyze the data scientifically and interpret them meaningfully

3. Specific Objectives and Contents

Specific Objectives	Contents
<ul style="list-style-type: none"> ● Define statistics and probability, and state the scope, importance and limitations of statistics. ● Explain the relations between statistics and information technology, and develop the concept of computer software in association with statistics. 	<p>Unit I: Concepts of Statistics and Probability (2 hr) Definition, importance, scope and limitations of statistics Role of probability theory in statistics Relations of statistics with information technology and e-methods.</p>
<ul style="list-style-type: none"> ● Define scales, attributes, variables and types of data, and also state the meaning of finite and infinite population, and sample, and distinguish between random and non-random sampling, ● To organize the data, classify and tabulate them for presentation, and use appropriate diagrams & graphs for data presentation. 	<p>Unit II: Concept of Population, Sample, Data and Variables and their types (3 hrs) Concept of attributes, scales, variables and their types, types of data, finite and infinite population, notation of sample, random and non-random sample. Presentation of data- organization, classification and tabulation of data, rules of tabulation (strugs rule), diagrams and graphs. Computational problems and examples</p>
<ul style="list-style-type: none"> ● Compute mean, median, mode, harmonic and geometric mean and partition values and interpret the results, and also state the properties ● Compute absolute and relative variation, range, quartile deviation, standard deviation, mean deviation and coefficient of variation, Lorenz 	<p>Unit III: Measures of Descriptive Statistics (8 hrs) Measures of locations- mean, median, mode, harmonic and geometric mean, partition values, and their use and properties. Measures of dispersion- variation (absolute and relative), range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Lorenz curve and gini-coefficient and</p>

<p>curve, gini-coefficient and also to interpret the result.</p> <ul style="list-style-type: none"> • Describe the concept and use of skewness and kurtosis (by using partition values, central and raw moments). 	<p>their interpretations and use, Measures of skewness and kurtosis, and their use. Computational problems and examples</p>
<ul style="list-style-type: none"> • To understand the terminologies of sample space, events, random experiment, trial, mutually exclusive events, equally likely cases, and to test the independence of the random variables. • To explain classical, statistical, axiomatic definitions of probability, basic principles of counting, permutation and combinations and compute them. • State additive, multiplicative, and conditional probability and compute probabilities, and state Bayes theorem and compute probability using Bayes theorem • Understand discrete & continuous random variables and to calculate probability distribution of a random variables • Compute expected values of discrete & continuous random variables 	<p>Unit IV: Basic Probability Theory (5 hrs) Basic terminology in probability- sample space, events, random experiment, trial, mutually exclusive events, equally likely cases, favourable events, independent and dependent events, Definition of probability- classical, statistical, subjective and axiomatic definitions, basic principles of counting, permutation and combinations, Laws of probability- additive, multiplicative, and conditional probability, Bayes theorem with examples. Random variables- discrete and continuous random variables, probability distribution of random variables Expectation- expected value of discrete and continuous random variables, and mean and variance of random variable with illustrative examples. Computational problems and examples</p>
<ul style="list-style-type: none"> • To understand the marginal and joint probability distribution functions, mass and density functions, • Compute mean, variance, co-variance and correlation of random variables. • To know the independent & dependent random variables, • To know Bernoulli, binomial and Poisson random variables, and their distributions and moments, and also to compute their probabilities, test the normality of the distributions by using chi-square test. • Fitting binomial and Poisson distributions, • State the normal distribution and its moments, standardization of normally distributed random variable, 	<p>Unit V: Probability Distributions (12hrs) Marginal and joint probability distributions, joint probability distribution of two random variables, marginal and joint probability mass functions and density functions Mean, variance, co-variance, and correlation of random variables, independence of random variables Discrete probability distributions- Bernoulli and binomial random variable and their distributions and moments. Computing binomial probabilities and fitting binomial distribution (relate with chi-square test of the distribution pattern of the frequency). Poisson random variable and its distribution and moments, and computing Poisson probabilities, and also fitting of Poisson distribution (relate with chi-square test of the frequency distribution). Continuous probability distribution- normal</p>

<ul style="list-style-type: none"> •To compute the areas under the normal curve, •Explain the negative exponential distribution and its moments, and also compute the probability. 	<p>distribution and its moments, standardization of normally distributed random variable, measurement of areas under the normal curve, Negative exponential distribution and its moments, Present the areas of application of above probability distributions. Computational problems and examples</p>
<ul style="list-style-type: none"> •To understand the definitions of chi-square, t and F random variables and their distributions and use them •Find the joint distribution of mean and sample variance of normal distribution 	<p>Unit VI: Distribution of Chi-square, t and F (2 hrs) Definitions and properties of chi-square, t and F distribution and their random variables and their distributions and their comparisons Find the mean and variance of these distribution (Proof is not required). Computational problems and examples</p>
<ul style="list-style-type: none"> •Understand simple random sampling methods and use it •Explain the sampling distribution and standard error and compute standard error and interpret the result •To know the distinction of descriptive and inferential statistics, point and interval estimation, •To understand the criteria of good estimator, maximum likelihood method of estimation •To estimate mean and variance in normal distribution, estimate the proportion in binomial distribution, •Compute the confidence interval of mean in normal distribution. •To know the step of testing of hypothesis, level of significance, types of error and power of the test. •Testing the hypothesis about mean in normal distribution in case of known variance (z-test) and unknown variance (t-test). •To carry out the ANOVA and also compute ANOVA table for one & two way classifications. 	<p>Unit VII: Inferential Statistics (8 hrs) Concept of sampling its types (probability and non probability) with merits and demerits. Steps of sample selection, determination of sample size. Sampling distributions and standard error in both case (with and without replacement) Distinction between descriptive and inferential statistics. Concept of point and interval estimation, and criteria of good estimator, Maximum likelihood method of estimation, and estimation of mean and variance in normal distribution, Estimation of proportion in binomial distribution and confidence interval of mean in normal distribution Concept of testing of hypothesis, level of significance, types of errors, power of the test, testing of hypothesis, concerning mean of a normal distribution in case of known variance and unknown variance. Concept of analysis of variance (ANOVA), computation of one way and two way analysis of variance. Computational problems and examples</p>
<ul style="list-style-type: none"> • To understand and use correlation and regression in information technology • Compute correlation and regression coefficients and interpret the results, 	<p>Unit VIII: Correlation and Regression (5 hrs.) 8.1.Simple correlation- scatter diagram, Karl Pearson's correlation coefficient, and its properties, standard error, probable error, significant test of correlation coefficient.</p>

<p>and also state the properties.</p> <ul style="list-style-type: none"> ● Explain the assumptions of model, least-square estimators technique, and test of significance, and to compute the coefficient of determination and interpret the results. Use the analysis of variance in regression. 	<p>Computation of partial and multiple correlations and their consistency (up to three variables)</p> <p>Simple linear regression- model and assumptionsof simple linear regression, least square estimators of regression coefficients, standard error of estimate, test of significance of regression coefficients, coefficient of determination, and analysis of variance (up to three variables)</p> <p>Computational problems and examples</p>
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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 and discussions.

Evaluation System

Undergraduate Programs				
External Evaluation	Marks	Internal Evaluation	Weightage	Marks
End semester examination	60	Assignments & Lab	10%	40
(Details are given in the separate table at the end)		Quizzes	10%	
		Attendance	10%	
		Presentation	10%	
		Internal exams	50%	
		Group work	10%	
Total External	60	Total Internal	100%	40
Full Marks 60+40 = 100				

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. Failing to get such score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear in the end semester examinations.

Practical examination: Practical examination will be taken at the end of the semester. Students must demonstrate the knowledge and skill of the subject matter.

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 as well as individual work
- Self study and assignments
- Presentation by students
- Term paper writing
- Quizzes and 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. Unless and until the student clears one semester he/she will not be allowed to study in the following semesters.

Prescribed Text

- Sheldon M. Ross. *Introduction to Probability and Statistics for Engineers and Scientists*, 3rd Edition, India, Academic Press, 2005.
- Shrestha, H.B. *Statistics and Probability- Concepts and Techniques*, EKTA Books Publication, Pvt. Ltd., reprint, 2008.

References

- Richard A. Johnson, Miller and Friends. *Probability and Statistics for Engineers*, 6th Edition, Indian reprint, Pearson Education, 2001.
- Ronald E. Walole, R.H. Myers, S.L. Myers, and K. Ye. *Probability and Statistics for Engineers and Scientists*, 8th Edition, Indian reprint, Pearson Education, 2001.
- Aryal, T.R. *Fundamental Statistics- Concepts and Practices*, Viddharthee Publication, Pvt. Ltd., 2010.
- Martin, A. *Research Methods, Statistics, IT and e-Methods*. Icon Publication Pvt. Ltd, 2004.
- Yamane, T. *Mathematics for Economics*. Prentice-Hall of India Pvt. Ltd, 2000.
- Aryal, T.R. *Biostatistics-For Biology, Medical and Health Sciences*, Pinnacle Publication, Pvt. Ltd., 2011.
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- Kapoor J. N. and H.C. Saxena. *Mathematical Statistics*, S. Chand & Company Ltd., New Delhi, India, 2001.
- Gupta S. C. and Kapoor V. K. *Fundamentals of Mathematical Statistics*, Sultan Chand and Sons, 2007.
- Rohatgi V. K. and Ehsanes Saleh, A. K. MD. *An Introduction to Probability and Statistics*, John Wiley & Sons, 2005.
- Hoel, Port and Stone. *Introduction to Probability Theory*, Houghton Mifflin Company Boston, 1971.
- Hogg R.V and Criag, A.T. *Introduction to mathematical statistics*, 3rd edition, Academic Press, USA.
- Sukubhattu, N. P. *Probability Theory and Statistical Methods*, 2nd edition, Asmita Publications, Kathmandu, 2063BS.
- Miller and Fruend. *Modern Elementary Statistics*, Pearson Publication, 2007.
- Shrestha, Ganga. *Fundamental of Statistics*. ASAN Publications, Kathmandu, Nepal, 2006
- Feller, W. *An Introduction to Probability Theory and its Applications*, Vol. 1, Third edition, John Wiley and Sons, Singapore, 2000.
- Hoel, Port and Stone. *Introduction to Probability Theory*, Houghton Mifflin Company Boston, 1971.
- Mayer, P. L. *Introductory Probability and Statistical Applications*, second edition, Oxford and IBH

- Publishing Co. Pvt Ltd, New Delhi, 1970.
- Spiegel, M.R. *Theory and Problems of Statistics*, McGraw Hill Book Company, Singapore, 1992.

Note-

- (i) Theory and practice should go side by side.
- (ii) At least Excel and SPSS software should be used for data analysis.
- (iii) It is recommended 45 hours for lectures and 15 additional hours for tutorial class for the completion of the course in the semester.
- (iv) Home works and assignments covering the lecture materials will be given throughout the semester.

FARWESTERN UNIVERSITY
FACULTY OF SCIENCE AND TECHNOLOGY,
SYLLABUS OF ZOOLOGY

Course Title: Chordata
Course No.: Zoo.231
Nature of course: Theory
Level: Undergraduate (B.Sc.)
Year: Second
Semester: III

Credits: 3
Total Instructional hours: 45
Full Marks: 80
 Internal assessment: 20
 End semester exam: 60
Pass Marks:
 Internal assessment: 10
 End semester exam: 27

Course Objectives:

The general objectives of the courses are:

- To make the B. Sc. in zoology programme more practical and relevant to the professional needs for National development.
- To upgrade the quality of the B. Sc. Programme so that the undergraduate students in zoology could compete academically with other universities.
- To make able to Classify the vertebrates up to orders with their examples.
- To provide knowledge about origin, evolution and adaptive radiation of various classes.
- To make able to discuss important concepts and phenomena in chordates.
- To make familiar with the vertebrate fauna of Nepal.
- To impart knowledge about the functional anatomy of chordates.

Course Description:

Units/specific objectives	Course contents	Instructional hours
1. Systematics: •To classify the vertebrates with typical characters and examples.	Diagnostic characters and classification of Higher Chordata (Cyclostomata, Pisces, Amphibia, Reptilia, Aves and Mammalia) up to orders with typical characters and examples.	5hrs.
2. Cyclostomata: •To differentiate between <i>Petromyzon</i> and <i>Myxine</i> .	Comparison between <i>Petromyzon</i> and <i>Myxine</i> .	1hr.
3. Pisces: •To discuss origin and evolution of chondrichthyes and osteichthyes and adaptive radiation in fishes. •To mention the peculiarities of Dipnoi. •To describe the different types of Scales and Fins found in fishes. •To describe Parental care in fishes. • To explain fish migration in Nepal. •To describe the status fish in Nepal.	Origin and evolution of fishes. Adaptive radiation. Dipnoi- distribution and peculiarities. Scales and Fins. Parental care in fishes. Fish migration and impact of dams on the migratory fishes of Nepal. Endemic species, diversity and distribution of fishes in Nepal.	6hrs.

<p>4. Amphibia:</p> <ul style="list-style-type: none"> •To discuss the origin, evolution and adaptive radiation of amphibian. • To differentiate between Paedogenesis and Neoteny. • To describe Parental Care in Amphibia. • To describe the status of amphibians in Nepal. 	<p>Origin and Evolution.</p> <p>Adaptive radiation.</p> <p>Paedogenesis and Neoteny- types, factors affecting neoteny and significance of neoteny.</p> <p>Parental Care in Amphibia.</p> <p>Endemic species, diversity and distribution of amphibians in Nepal.</p>	<p>4hrs.</p>
<p>5. Reptilia:</p> <ul style="list-style-type: none"> •To discuss the origin, evolution and Adaptive radiation of reptiles. • To discuss the affinities of <i>Sphenodon</i>. •To explain Poison apparatus, biting mechanism, snake venom and its effect of poisonous snake and first aid treatment of snake bite. •To differentiate between Poisonous and non-poisonous snakes. • To describe the status of reptiles in Nepal. 	<p>Origin and Evolution.</p> <p>Adaptive radiation.</p> <p><i>Sphenodon</i>-peculiarities and affinities.</p> <p>Poisonous and non-poisonous snakes- Poison apparatus, biting mechanism, snake venom, symptoms and first aid treatment of snake bite, distinction between Poisonous and non-poisonous snakes .</p> <p>Endemic species, diversity and distribution of reptiles in Nepal.</p>	<p>6hrs.</p>
<p>6. Aves:</p> <ul style="list-style-type: none"> •To discuss the origin, evolution and Adaptive radiation of birds. • To describe the principal types of palate met with in birds. • To give an account of mechanism and modes of flight in birds. • To give an account of perching mechanism in birds. • To explain bird migration in Nepal. •To list the pheasants of Nepal. • To describe the status of birds in Nepal. 	<p>Origin and Evolution.</p> <p>Adaptive radiation.</p> <p>palate- types and importance.</p> <p>Principles of aerodynamics in Bird flight and Modes of flight.</p> <p>Perching mechanism.</p> <p>Bird migration in Nepal.</p> <p>Pheasants of Nepal.</p> <p>Endemic species, diversity and distribution of birds in Nepal.</p>	<p>7hrs.</p>
<p>7. Mammalia:</p> <ul style="list-style-type: none"> •To discuss the origin, evolution and Adaptive radiation of mammals. • To give an account of dentition in mammals. • To describe the status of mammals in Nepal. 	<p>Origin and Evolution.</p> <p>Adaptive radiation.</p> <p>dentition.</p> <p>Endemic species, diversity and distribution of mammals in Nepal.</p>	<p>4hrs.</p>

<p>8. Comparative Anatomy</p> <ul style="list-style-type: none"> • To give a comparative account of integument and its derivatives in vertebrates. • To give a comparative account of axial skeleton in vertebrates. • To give a comparative account of digestive organs in vertebrates. • To give a comparative account of respiratory organs in vertebrates. • To give a comparative account of heart and aortic arches, Portal systems, Lymphatic system in vertebrates. • To give a comparative account of evolution of kidney, gonads and their ducts in vertebrates. • To give a comparative account of brain and Cranial nerves in vertebrates. • To give a comparative account of structure of eye and ear in vertebrates. 	<p>Integument: Structure and derivatives of integument.</p> <p>Skeletal System: General plan of neurocranium and dermatocranium, Vertebrae.</p> <p>Digestive System: Brief account of Alimentary canal and associated glands.</p> <p>Respiratory System: Brief account of Skin, gills, lungs and air sacs; Accessory respiratory organs.</p> <p>Circulatory System: Evolution of heart and aortic arches, Portal systems, Lymphatic system.</p> <p>Urinogenital System: Succession of kidney, Evolution of urinogenital ducts. Gonads and their ducts.</p> <p>Nervous System: Comparative account of brain and Cranial nerves.</p> <p>Sense Organs: Classification of receptors, Brief account of visual and auditory receptors in vertebrates.</p>	<p>12hrs.</p>
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References:

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Bhujju, U.R., Shakya, P.R., Basnet,T.B. & Shrestha, S. (2007). Nepal Biodiversity Resource Book. ICIMOD.

Majupuriya, T.C. & Majupuriya, R.K. (2006). Wildlife and Protected Areas of Nepal. S. Devi, Saharapur, India.

Shrestha,J. (1995). Enumeration of Fishes of Nepal. In Biodiversity Profile Project Publication No. 10 Kathmandu: HMG/N Department of National Parks and Wildlife Conservation, Ministry of Forest and Soil Conservation.

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Jnawali, S.R., Baral, H.S., Lee, S., Acharya, K.P., Upadhyay, G.P., Pandey, M., Shrestha, R., Joshi, D., Laminchane, B.R., Griffiths, J., Khatiwada, A. P., Subedi, N., and Amin, R. (compilers) (2011). The Status of Nepal Mammals: The National Red List Series, Department of National Parks and Wildlife Conservation Kathmandu, Nepal.

Inskipp C., Baral H. S., Phuyal S., Bhatt T. R., Khatiwada M., Inskipp, T, Khatiwada A., Gurung S., Singh P. B., Murray L., Poudyal L. and Amin R. (2016). The status of Nepal's Birds: The national red list series. Zoological Society of London, UK.

FARWESTERN UNIVERSITY
FACULTY OF SCIENCE AND TECHNOLOGY
SYLLABUS OF ZOOLOGY PRACTICAL

Course Title: Chordata
Course No.: Zoo.231
Nature of Course: Practical
Level: Undergraduate (B. Sc.)
Year: Second
Semester: III

Credit: 1
No. of Hours/Week: 3
Total Hours: 45
Full Marks: 20
Pass Marks: 10

Course Objectives:

At the end of the course, the students will be able to:

- Develop the skill of museology.
- Classify and describe the various vertebrate animals.
- Compare the endoskeletons of vertebrates.
- Explain the histological structures of different organs of vertebrates.
- Prepare the permanent slides of different organs and tissues.
- Expose and identify internal organ systems of different vertebrates.
- Explore vertebrate fauna in locality.

Course description:

SN	Units	Course contents
1	Museology	Methods of collection, preservation and maintenance of various animal specimens.
2	Museum Specimens	Study of museum specimens of at least one member of each order of the class of vertebrate.
3	Osteology	Comparative Study of the skeleton of <i>Scoliodon</i> , <i>Rana</i> , <i>Varanus</i> , fowl and rabbit.
4	Histology	Comparative Study of permanent slides of TS/VS of the skin, oesophagus, stomach, Intestine, liver, Pancreas, lung, kidney, testis, ovary and spinal cord of vertebrates.
5	Specimens/Models/Charts	Study of different types of scales (prepared slides); Biting mechanism of a poisonous snake (model); feathers- Contour, filoplume and down feathers; Perching mechanism (model).
6	Permanent Mounting	Make permanent stained preparations of the Placoid, Cycloid and Ctenoid scales, Ampulla of Lorenzini, Striated muscles, Pecten and Filoplume of bird.
7	Dissection	7.1 Dissection of fish (<i>Scoliodon/Labeo</i> /locally available fish): General anatomy, Digestive organs, Heart and afferent and efferent branchial vessels, urinogenital system, Brain and cranial nerves, Ear ossicle.

		<p>Dissection of amphibian (<i>Rana</i>): General anatomy, Digestive organs, Arterial and Venous system, Urinogenital system, Brain, cranial nerves</p> <p>Dissection of reptile (<i>Hemidactylus/Calotes</i>): General anatomy, Digestive organs, Arterial and Venous system, Urinogenital system, Brain, cranial nerves.</p> <p>Dissection of bird (<i>Columba/Gallus</i>): General anatomy, Digestive organs, Air sacs, Arterial and Venous system, Urinogenital system, Brain, cranial nerves and pecten.</p> <p>Dissection of mammal (<i>Rattus/Funambulus</i>): General anatomy, Digestive organs, Arterial and Venous system, Urinogenital system, Brain, cranial nerves,</p>
8	Zoological Excursion and report writing	Visit protected areas/forest/lake/river/zoo to survey vertebrates and prepare reports.

Reference:

Verma, P.S. (2016). A Manual of Practical Zoology Chordates, 11th Edition. S. Chand Publishing, New Delhi.

Kent, G.C. and Carr R.K. (2001). Comparative Anatomy of the Vertebrates, 9th Edition. The McGraw-Hill Companies, New York.

Scheme of Evaluation:

Dissection.....	6 Marks
Permanent Slide Preparation.....	2 Marks
Spotting of Museum specimens/Bones/Slides...	5 Marks
Report Writing/Collection.....	3 Marks
Viva-Voce.....	2 Marks
Class Record.....	2 Marks

FAR WESTERN UNIVERSITY

Faculty of Science and Technology

Course Title: Basic Chemistry III
 Course No.: CHM231
 Nature of Course: Theory
 Level: B. Sc.
 Year: Second, Semester: Third

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 chemical kinematics and chemistry of cycloalkanes, aromatic compounds, phenols and alcohols and s & p block elements.

(2). Course Objectives:

The general objectives of the course are as follows:

- To acquaint the students with basic concepts of the chemical kinematics and photochemistry.
- To enable the students to understand the principles behind bonding, preparation, reactions and uses of cycloalkanes, aromatic compounds and phenols & alcohols.
- To acquaint the students with chemistry of essential concepts of s & p block elements.
- 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:

Specific Objectives	Physical Chemistry Contents
<ul style="list-style-type: none"> • Explain the differences between homogenous and heterogeneous reactions. • Define reaction rate and explain the factors affecting the reaction rate giving examples. • Explain the differences between order and molecularity of the reactions. • Derive rate equations for zero, first, second and third order reactions. • Explain reversible and parallel reactions. • Using energy profile diagrams, explain exothermic and endothermic reactions. • Discuss what constitutes the reaction mechanism taking into account of rate determining step, collision theory of the reaction rate, transition state and activation energy concepts. • Describe the significance of Arrhenius equation. • Work out the mechanism of some well known reactions. • Define catalysts and explain different types of catalysts. • Discuss the mechanism of catalysis. • Discuss the enzyme catalysis with the introduction of Michaelis-Menten equation. • Introduce the terms K_m and K_s. • Explain the preliminary account of enzyme inhibition. 	<p>Unit I: Chemical Kinetics (11) Homogenous and heterogeneous reactions; Reaction rate; Factors affecting the reaction rate; Order and molecularity of the reactions; Zero, first, second and third order reactions and derivation of their rate equations; Experimental methods of determining reaction rate; Reversible reactions; Parallel reactions; Chain reactions Energy changes in a reaction; Mechanism of a reaction; Rate determining step; Theories of reaction rates (collision and transition state theory); Activation energy; Arrhenius equation; Kinetic studies of some reactions (the reaction between H_2 and Br_2 to form HBr, the Cannizzaro reaction involving formaldehyde, acid and base catalyzed iodination of propane) Catalysis; Homogenous and heterogeneous catalysts; Types of catalysts; Poisons, promoters and inhibitors; Theories of mechanism of catalysis; Homogenous catalysts in gases and liquids; Kinetics of enzyme catalysis; The Michaelis-Menten equation (derivation not required); The Michaelis constant K_m and substrate constant K_s; Enzyme inhibition</p>
<ul style="list-style-type: none"> • Introduce basic idea about electromagnetic radiation. • Explain about Lambert-Beer's law, Grotthus-Draper law and Stark Einstein law of photochemical equivalence. • Describe different types of photochemical reactions including fluorescence, phosphorescence and chemiluminescence. 	<p>Unit II: Photochemistry (4) Electromagnetic radiation; Light absorption; Lambert-Beer's law; Physical significance of absorption coefficient; Laws of photochemistry; The Grotthus-Draper law; Stark Einstein law of photochemical equivalence; Quantum yield; Examples of low and high quantum yields; Photochemical reactions; Photosensitized reactions; Quenching; Fluorescence; Phosphorescence; Chemiluminescence</p>
Organic Chemistry	
<ul style="list-style-type: none"> • Explain nomenclature, geometrical isomerism and stability of cycloalkanes. • Discuss Baeyer strain theory. • Explain conformational analysis along with the factors that determine stability of conformations. • Describe conformations of cyclopropane, cyclobutane, cyclopentane and cyclohexane. 	<p>Unit I: Cycloalkane (4) Cycloalkanes; Nomenclature; <i>cis-trans</i> isomers; Stability of cycloalkanes; Baeyer strain theory; Conformational analysis; Factors affecting stability of conformations; Equatorial and axial bonds; Conformations of cyclopropane; cyclobutane; cyclopentane and cyclohexane</p>

<ul style="list-style-type: none"> Describe sources, names, structure and stability of aromatic compounds (benzene). With the help of Huckel's rule, define aromatic, non-aromatic and antiaromatic compounds with giving pertinent examples. Explain electrophilic aromatic substitution reactions giving mechanism. Discuss orientation and reactivity in mono-substituted and distributed benzenes. 	<p>Unit II: Benzene and Aromaticity (5) Sources and names of aromatic compounds; Structure and stability of benzene; Huckel's rule; Aromatic, non-aromatic and antiaromatic compounds with examples; Electrophilic aromatic substitution reactions (nitration, halogenations, sulphonation, Friedel Craft alkylation and acylation and their mechanism); Effect of substituents on electrophilic substitution reactions; <i>Ortho-para</i> and <i>meta</i> directing groups; Orientation and reactivity in mono-substituted and disubstituted benzenes</p>
<ul style="list-style-type: none"> Describe nomenclature and properties of alcohols and phenols. Explain various methods of preparation of alcohols. Give major types of reactions of alcohols. Explain main reactions of phenols. Explain nomenclature, preparation and reactions of ethers. 	<p>Unit III: Alcohols, Phenols and Ethers (6) Naming alcohols and phenols; Properties of alcohols and phenols; Preparation of alcohols (Reduction of aldehydes and ketones, Reduction of carboxylic acids and esters); Reactions of carbonyl compounds with Grignard reagents; Reactions of alcohols (Conversion into alkyl halides, Conversion into tosylates, Conversion into esters, Dehydration, oxidation and protection of alcohols); Phenols and their uses; Electrophilic aromatic substitution reaction; Oxidation of phenols Names and properties of ethers; Synthesis of ethers (The Williamson synthesis, Alkoxymercuration reaction); Reaction of ethers (Acidic cleavage, Claisen rearrangement); Epoxides; Acid and base catalyzed epoxide opening</p>
Inorganic Chemistry	
<ul style="list-style-type: none"> Explain general characteristics of the alkali metals. Describe chemical properties of the alkali metals. Explain some chemical reactions of the alkaline earth metals along with some uses. 	<p>Unit I: s – Block Elements (6) General Characteristics of alkali metals Density; Melting and boiling points; Flame colours and spectra; Anomalous behavior of first member of each group Chemical properties: Reactions with water, air and nitrogen; Solution of metals in liquid ammonia and their properties; Compounds with carbon; Crown and crypt ethers; Uses of alkali metals with reference to Lithium in drugs and batteries Alkaline earth metals: Anomalous behavior of Beryllium; Solutions of metals in liquid ammonia; Reaction with water; Hydrides; Grignard's reagent; Chlorophyll and photosynthesis; Biological roles of Mg ion and Ca ion.</p>
<ul style="list-style-type: none"> Explain the extraction of aluminum along with some important compounds of aluminum and boron. Describe structure and allotropy of group IV elements. Explain chemistry of some important compounds of carbon and silicon. Describe chemistry and uses of some important compounds of nitrogen and phosphorus. Describe acid rain, detergent as well as chemistry of thionyl chloride, tetrasulphur tetranitride and organo derivatives. 	<p>Unit II: p – Block Elements (9) Group III elements: Extraction of aluminum; Uses of aluminum; Alum; Cement; Borax; Borohydrides; Boron trifluoride; 2-electron 3-centered bond; Alumina; Aluminum chloride; Aluminum alkyls Group IV elements: Structure and allotropy; Difference between carbon, silicon and the remaining elements; Carbon dating; Inert pair effect; Carbides; Carbon oxides; Silicates; Silicones; Internal pi bonding using d orbitals; Freons Group V elements: The nitrogen cycle; Liquid ammonia as a solvent; Fertilizers; Nitrogen fixation; Phosphate fertilizer; Halides Group VI elements: Acid rain; $p\pi - d\pi$ bonding; Difference between oxygen and other elements; Thionyl chloride; Detergents; Tetrasulphur tetranitride; Organo derivatives Group VII elements: Preparation of fluorine; Perchloric acid; Halogen oxides Group 0 elements: Occurrence and recovery of the elements; Uses of elements; Chemical properties of the Noble gases</p>

Note: The figures in the parentheses indicate the approximate periods of the respective units.

(4). Evaluation System

Undergraduate Programs							
External Evaluation	Marks	Internal	Weight	Marks	Viva-voce	Weight	Mark

		Evaluation	age			age	
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**, 5th 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
Chemistry Practical III Semester

Course Title: **Chemistry Lab 3**

Course Code: **CHM 231**

Nature of Course: **Laboratory**

Level: **B. Sc.**

Year: **Second**, Semester: **Third**

Full Marks: **20**

Pass Marks: **09**

Credit: **1**

Number of hours per week: **3**

Teaching Hours: **45**

Course Description

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

Course Objectives

The general objectives of the course are follows;

To enable students to perform experiments on the kinetics of the reactions.

To enable the students to develop basic skills on one step organic preparation.

To enable the students to develop skill on qualitative analysis of simple inorganic salt mixture.

To enable students to develop skill on observation, recording and interpretation of an experiment.

Specific Objectives and Contents

Specefic Objectives	Contents
<ul style="list-style-type: none"> • Enable the students to undertake experiments on chemical kinetics and interpret the results obtained. • Enable the students to verify Beer-Lambert's law and determine concentration of metal ions spectrophotometrically. • Enable the students to perform experiments on one step organic preparation based on oxidation, acylation, benzylation, reduction, hydrolysis and diazotization/coupling reactions. • Enable the students to qualitatively detect cations and anions presents in inorganic mixture. 	<p><u>Physical Chemistry Contents</u></p> <ol style="list-style-type: none"> 1. Determiation of rate constant of hydrolysis of ethyl acetate by sodium hydroxide 2. Determiation of activation energy for acid catalyzed hydrolysis of methly acetate. 3. Determiation of the order of reaction of acid cataylyzed iodination of propanone. 4. Verification of Beer-Lambert's law and determination of concentration of metal ions spectrophotometrically. <p><u>Organic Chemistry Contents</u></p> <ol style="list-style-type: none"> 1. Oxidation: Oxidation of toluene to benzoic acid. 2. Acylation: Acetylation of salicylic acid and aniline. 3. Benzylation: Benzylation of phenol. 4. Reduction: Reduction of nitro compounds. 5. Hydrolysis: Hydrolysis of ethyl

benzoate or methyl salicylate.

6. Diazotization/Coupling:

Preparation of methyl orange.

Inorganic Chemistry Content

1. Qualitative analysis of simple inorganic salt mixture containing 2 cations and 2 anions: Hg^+ , Pb^{++} , Ag^+ , Cu^{++} , Hg^{++} , As^{+++} , Sb^{+++} , Sn^{++} , Bi^{+++} , Cd^{++} , Al^{+++} , Zn^{++} , Mn^{++} , Fe^{+++} , Co^{++} , Ni^{++} , Cr^{+++} , Ca^{++} , Ba^{++} , Sr^{++} , Mg^{++} , K^+ , NH_4^+ , NO_3^- , Cl^- , Br^- , I^- , SO_4^{--2} , CO_3^{--2} , PO_4^{--3} .

4. Instructional Techniques

Before the start of an experiment the instructor presents on the details of the experiment including the safety considerations. Each student will perform independently all the experiments prescribed.

5. Evaluation

There will be continuous examination of the students. After the submission of the report of each experiment by the students, the instructor provides the grade. Besides this, the instructor takes quizzes and short examination on the experiments done at frequent intervals amounting to 25% of total grade. The final grade will be the accumulation of all individual grades. There will be no final examination.

6. Attendance in Lab : Students should complete all the experiments prescribed.

7. Texts

1. David P. Shoemakes, Carl W. Garlamnd, Joseph W Nibler, **Experiments in Physical Chemistry** 5th Edition, McGraw-Hill Book Co,pany,1989(Latest Edition)
2. B.P. Levitt,ed, **Findlay's Practical Chemistry**, Longman, London **1973**, (Latest Edition).
3. J.NGurtu, R.Kapoor, **Advanced Experiments Chemistry** (Vol 1 – II), S. Chand and Co., New Delhi, India, 1989 (Latest Edition)
4. B.S. Furniss, A.L. Hannaford, P.W.G. Smith, A.R. Tatchel, **Vogel's Text Book of Practical Organic Chemistry**, 5th Edition, Pearson Education, 2005.
5. A.L. Vogel, **Qualitative Inorganic Analysis**, Prentice Hall, Latest Edition.
6. L.Shriener, R.C.Fusion, D.Y. Curtin, **The Systematic Identification of Organic Compounds, A Laboratory Manual**, John Wiley and Sons Inc., New York, USA.
7. N.S. Gnanapragasam, G. Ramamurthy, **Organic Chemistry- Lab Manual**, S. Viswanathan Co. Pvt. India, 1998.
8. **Vogel's Text Book of Inorganic Qualitative Analyses**, 4th Edition, ELBS. London, **1974** (Latest Edition)
9. MotiKajiSthapati, R.R.Pradhananga, **Experiment Physical Chemistry**, TalejuPrakashan, Kathmandu, Nepal, **1998**.
- 10.K.N. Ghimire, M.R. Pokharel K.P. Bohara, **University Experimental Inorganic Chemistry**, Quest Publication, Kirtipur, Kathmandu, Nepal, **2008**.
- 11.N.M. Ghimire, S. D. Gautam, P.N. Yadav, **A core Experimental Chemistry for B.Sc.,Kaea Book Centre, Kathmandu, Nepal, 2008**.
12. K.N. Ghimire, K.P. Bohara, **University Experimental Physical Chemistry**, Quest Publication, Kathmandu, Nepal, **2008**.