Far Western University
Mahendranagar, Kanchanpur
Faculty of Science and Technology

B. Sc. Third Semester Physical Group

FAR WESTERN UNIVERSITY

Faculty of Science and Technology

Course Title: Basic Chemistry III F.M.: 100
Course No.: CHM231 P.M.: 45%
Nature of Course: Theory Credit: 3
Level: B. Sc. Number of hours per week: 3
Year: Second, Semester: Third 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
• 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.	**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 Cannizaro 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

• 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.	**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
Organic Chemistry	
• 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.	**Unit I: Cycloalkane (4)** Cycloalkanes; Nomenclature; *cis-trans* isomers; Stability of cycloalkanes; Baeyer strain theory; Conformational analysis; Factors affecting stability of conformations; Equitorial and axial bonds; Confromations of cyclopropane; cyclobutane; cyclopentane and cyclohexane
• 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.	**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; *Ortho-para* and *meta* directing groups; Orientation and reactivity in mono-substituted and disubstituted benzenes
• 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.	**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
Inorganic Chemistry	
• 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.	**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.

• 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.	**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

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

(4). Evaluation System

Undergraduate Programs							
External Evaluation	**Marks**	**Internal Evaluation**	**Weightage**	**Marks**	**Viva-voce**	**Weightage**	**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 willbe 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**		Full Marks:	**20**
Course Code: **CHM 231**		Pass Marks:	**09**
Nature of Course: **Laboratory**		Credit:	**1**
Level: **B. Sc.**		Number of hours per week:	**3**
Year: **Second**, Semester: **Third**		Teaching Hours:	**45**

1. 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.

2. 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.

3. Specific Objectives and Contents

Specefic Objectives	Contents
• 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 onone step organic prepration based on oxidation, acylation, benzoylation, reduction, hydrolysis and diazotization/coupling reactions. • Enable the students to qualitatively detect cations and anions presents in inorganic mixture.	**Physical Chemistry Contents** **1.** Determination of rate constant of hydrolysis of ethyl acetate by sodium hydroxide **2.** Determination of activation energy for acid catalyzed hydrolysis of methly acetate. **3.** Determination 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. **Organic Chemistry Contents** **1.** Oxidation:Oxidation of tolune to benzoic acid. **2.** Acylation: Acetylation of salicylic acid and anililine. **3.** Benzoylation: Benzoylation of phenol. **4.** Reduction: Reduction of nitro compounds. **5.** Hydrolysis: Hydrolysis of ethyl benzoate or methyl salicylate. **6.** Diazotization/Coupling:

	Preparation of methyl orange. **Inoraganic Chemistry Content** **1.** Qualitative analysi of simple inorganic salt mixture contaning 2 cationsand 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^{-}, 1^{-}, 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 individualgrades. There will be no final examination.

6. Attendance inLab : 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 l – ll), 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.Shriner, 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**.

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 geologicalprocesses.
- To enhance students understanding on broader aspects of environmental Science linkingGeology 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
• 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.
• Provide Knowledge on weathering, erosion and its types. • Discuss about physio -Chemical and biological properties of soil. • Explain about soil profile, its formation and soil types of Nepal. • Provide knowledge on Geological work of wind and Water.	**Unit-2:Geological Surface processes and Environment 15 hrs** Geological surface processes : Weathering and erosion: types, Characteristics, factors; Erosion cycle; 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.

• Describe about Mass movements, their causes and types. • Discuss about erosional land forms and depositional land forms of fluvial environment.	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.
• 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.	**Unit 3: Environmental Geology 15 hrs** 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.
• 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.	**Unit4 - Geo -Environmental Skills 15 hrs** 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; 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.

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 IndiaLimited.

3. Avery, T.E. and Berlin, G.L. 1992, Fundamentals of Remote Sensing and Air PhotoInterpretation, 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 PrenticeHall, New Delhi.

6. Critchfield, H.J. *General Climatology* Prentince 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, Belland Howell company, columbus, Ohio.

10. Mahapatra, G. B., (2008).Text Book of Physical Geology, CBS Publishers andDistributers, India.

11. Punmia, B.c, Jain A.k. (2005), Surveying Vol. I , Surveying Vol. II, 16 thpublication.Laxmi PublicationsP. Ltd, New Delhi.

12. Reineck, H.E and Barrett, G. W. (1990).Depositional Sedimentary Environments withreference 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: -Env231
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) andcommon minerals in hand on specimen.
4. Rock mass classification
5. Study of soil profile: recording profile, sampling of soil and laboratory study of soilsamples, 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.

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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 techniquesis 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 examinationevaluation 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%, thebases 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 forsubmission 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 thetopics as taught in the sessions. Mid-term examination will be based on the model prescribed forEnd-term examination.

b) End-Term/External Examinations: It is also a written examination and the questions will beset 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 andPhysical 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	

FAR WESTERN UNIVERSITY
Faculty of Science and Technology

Course Title: Real Analysis I F.M.: 100
Course No.: MTH231 P.M.: 45%
Nature of Course: Theory Credit: 3
Level: B. Sc. Number of hours per week:3
Year: Second, Semester: Third Teaching Hours: 45

1. **Course Description:**
   This course aims to enable the students to gain basic knowledge about sets, functions, symbolic logic, real numbers, absolute values of real numbers, open sets, closed sets, sequence and series of real numbers whichare considered to be backbone of real analysis. After the study of topics, the students will familiarize and able to understand the subject matter and their applications in further studies.
2. **Course Objectives:**
   The general objectives of the course are as follows:
   - To enable the students with basic concepts of sets, functions, symbolic logic and real number system.
   - To enable the students about basic knowledge of open sets, closed sets and other related topics.
   - To enable the students to gain the basic knowledge about infinite sequences and infinite series of real numbers.
3. **Specific Objectives and Contents of Study:**

Specific Objectives	Contents in Detail
* Define sets and illustrate different types of sets with examples. * Give concepts of set operations (union, intersection, complement of sets, difference of sets). * Define Cartesian products of two sets.	**Unit 00: Review of Basic Concepts** Sets and Set Operations Cartesian Products and Relations
* Define relation from a set to another set and state domain, co-domain and inverse relation of a relation. * Define function and state different types of functions. * Define composition of functions and illustrate some examples of composition of functions. * Define inverse of a function. * Define cardinality of sets. * State countable and uncountable sets and state their properties. * Define sentence and mathematical statement. * State compounds statement, negation, conjunction, disjunction, conditional and biconditional statements with examples. * Clarify the meaning of tautology and contradiction. * Define quantifiers. * State basic laws of logic. * Explain about techniques of proof.	**Unit 01: Sets, Functions and Logic 8 Hrs** Functions and Types of Functions Composition of Functions Inverse of a Function Cardinatity of a Set Countable and Uncountable Sets and Their Properties Sentence and Statement Compound Statements with Connectives Tautology and Contradiction Quantifiers Basic Laws of Logic Techniques of Proof Proof by Mathematical Induction

* Define natural numbers, whole numbers, set of integers, rational and irrational numbers with examples. * Explain Peano's axioms. * State field axioms. * State order axioms. * Explain the meaning of absolute values of real numbers and explain some properties of real numbers. * Define bounded above, bounded below and bounded sets with examples. * State completeness axioms. * Define supremum and infimum of set of real numbers and state some of their properties. * State and prove Archimedean property of real numbers.	**Unit 02: Real Number Systems** **7 Hrs** Introduction of Different Number Systems Peano's Axioms Field Axioms Order Axioms Absolute Values of Real Numbers and Their Properties Bounded Sets and Completeness Axioms Supremum and Infimum of Sets and Their Properties Archimedean Property Rational Density Theorem and Irrational Density Theorem
* State and prove rational density theorem and irrational density theorem. * Explain the meaning of countable and uncountable subset of real numbers with their properties. * Solve some related problems.	Countable and Uncountable Subsets of Real Numbers Geometrical Representation of Real Numbers Extended Real Number System
* Explain the open, closed, semi-open and semi-closed sets. * Define neighborhood of a point and interior of a point. * Define open sets with examples. * State and prove some theorems related to open sets. * Define closed sets. * State and prove some theorems related to closed sets. * Define adherent point of a set. * Define limit point of a set. * Define boundary point of a set. * State Bolzano – Weierstrass Theorem. * State nested interval theorem without proof. * Define perfect set with examples.	**Unit 03: Point Set Topology of Real Line** **6 Hrs** Open and Closed Intervals Neighborhoods and Interior Points Open Sets Closed Sets Some Theorems Concerning Open and Closed Sets Adherent, Limit and Boundary Points of a Set Bolzano – Weierstrass Theorem Nested Interval Theorem without Proof Perfect Sets
* Define infinite sequences with examples. * State convergence and divergence of sequences of real numbers. * State and prove theorems related to convergent sequences. * Definition of increasing and decreasing sequences and hence monotone sequences also. * Some theorems related to monotone sequences. * Clarify the meanings of bounded sequences. * Explain the meanings of sub-sequences with examples. * State and prove Bolzano – Weierstrass theorem for sequences. * Define Cauchy's sequences. * State and prove some theorems related to Cauchy's sequences.	**Unit 04: Sequence of Real Numbers** **11 Hrs** Sequences; Sequences of Real Numbers Convergence and Divergence of Sequence of Real Numbers Operations on Convergent Sequences Convergence of Monotone Sequences Bounded Sequence Sub – sequences Bolzano – Weierstrass Theorem for Sequence Cauchy's Sequences and Convergence

* Explain the meaning of infinite series of real numberswith examples. * Clarify the meaning of partial sums and sequence ofpartial sums of given infinite series. * State convergence and divergence of infinite series. * Explain about Cauchy's criteria for convergence of series. * Define series of positive terms and alternating series. * State and prove different test of convergence or divergence of series as ➢ p-series test ➢ Leibnitz's test ➢ Direct comparison test ➢ Limit comparison test ➢ D' Alembertz ratio test ➢ Cauchy's root test etc * Define absolute and conditional convergence of infiniteseries. * Solve some related problems of infinite series.	**Unit 05: Infinite Series of Real Numbers 13 Hrs** Series of Real Numbers Convergence and Divergence of an Infinite Series Cauchy's Criteria of Convergence Series of Positive Terms Alternating Series Different Tests for Convergence and Divergenceof Infinite Series (p-series Test, Leibnitz's Test, Direct Comparison Test, Limit Comparison Test, D' Alembertz Ratio Test, Cauchy's Root Test) Absolute and Conditional Convergence Exercises

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. Prescribed Books and References:

i. Real Analysis – P. M. Bajracharya, Buddha Publication
ii. Mathematical Analysis – R. M. Shrestha, Sukunda Pustak Bhawan
iii. Real Analysis – S. M. Maskey
iv. Mathematical Analysis – N. P. Pahari
v. Mathematical Analysis – T. M. Apostol
vi. Real Analysis – Shanti Prasad, S. Chand and Company Ltd., New Delhi

FAR WESTERN

UNIVERSITY

Faculty of Science and

Technology

Course Title: Ordinary and Linear Algebra F.M.: 100
Course No.: MTH232 P.M.: 45%
Nature of Course: Theory Credit: 3
Level: B. Sc. Number of hours per week: 3
Year: Second, Semester: Third Teaching Hours: 45

1. **Course Description:**
   This course of Mathematics is designed to provide students to use linear algebra and its skills in different fields of mathematics, physics and engineering etc of general sciences and technical sciences. The course emphasizesboth quantitative and qualitative aspects of ordinary and linear algebra involving the topics matrices and determinants, vectors in real n-space, vector spaces and subspaces, linear transformations and different types of polynomial equations
2. **Course Objectives:**
   The general objectives of the course are as follows:
   - To enable the students to gain basic knowledge of matrices and determinants.
   - To enable the students to know about vectors in real n-space, vector spaces and sub-spaces and lineartransformation.
   - To enable the student to solve the different types of polynomial equations such as cubic and biquadratic equations.
   - To enable the students, the applications of different topics in applied mathematics, general sciences and technical sciences etc.

3. **Specific Objectives and Contents of Subject Matter:**

Specific Objectives	Contents in Detail
* Explain the meaning of matrix with different examples. * Define some standard matrices with examples. * Clarify about the algebra of matrices. * Define transpose of a matrix and explain the propertiesof transpose of a matrix. * Define symmetric and skew-symmetric matrices withexamples. * Explain the meaning of determinant of square matriceswith examples. * Explain the properties of order 3×3. * Define adjoint of a square matrix. * Define inverse of a square matrix. * Explain the properties of square and adjoint of a matrix.	**Unit 01: Matrices and Determinants** **8 Hrs** Matrices, Some Standard Matrices Algebra of Matrices Transpose of a Matrix and Its Properties Symmetric and Skew Symmetric Matrix Determinant of a Square Matrix Minors and Cofactors Properties of Determinants Adjoint of a Square Matrix Inverse of a Square Matrix Properties of Adjoint and Inverse of a Matrix
* Define vectors in n-space with examples. * Explain about algebraic operations of points in n-space. * Define scalar product with some of the standard properties of scalar product. * Define norm of a vector. * Clarify the meaning of distance between two vectors.	**Unit 02: Vectors in Real n-space** **5 Hrs** Vectors in n-space Algebraic Operations of Points in n-space Scalar Product Norm, Distance and Angle Scalar and Vector Projections Orthogonality

* Define angle between two vectors in terms of scalarproduct. * Explain the scalar and vector projections of a vector onanother vectors. * Clarify the meaning of orthogonality.	
* Define vector spaces with some examples. * Explain some standard properties of vector spaces. * Define vector subspaces.	**Unit 03: Vector Spaces and Subspaces 7 Hrs** Vector Spaces Properties of Vector Spaces
* Explain the meaning of sums and direct sums of vectorsubspaces. * Clarify the concept of linear combinations, dependentand independent of vectors in a vector space. * Define basis and dimensions of a vector space. * Define scalar product of vectors. * Discuss about norm and distance. * Clarify the meaning of orthogonality and orthonormalitywith examples. * Discuss about orthogonal and orthonormal basis of vectorspaces. * Solve some related problems.	Vector Sub-spaces Sums and Direct Sums of Vector Subspaces Linear Combinations, Dependent andIndependent Vectors Basis and Dimensions Scalar Product Norm and Distance Orthogonality and Orthonormality Orthogonal and Orthonormal Basis and Related Problems
* Define linear transformation with examples. * Discuss about kernel and image of linear transformation. * Verify algebra of linear transformations. * Explain about composition of two linear transformations. * Verify that composition of two linear transformation isalso linear. * Define inverse of linear transformation and prove thatinverse of linear transformation is also linear. * Explain the meaning of matrix representation of linear transformation.	**Unit 04: Linear Transformations 5 Hrs** Linear Transformations Kernel and Image of Linear Transformations Algebra of Linear Transformations Matrix Representation of Linear Transformations
* Define polynomials and polynomial equation of differentdegrees. * Discuss about properties of polynomial equations. * Explain about 'Descartes' rules of signs. * Discuss about relation between roots and coefficients ofpolynomial equations of degree n in x. * Discuss about different transformations of equations withexamples. * Clarify the multiple roots of polynomial equations. * Explain about sum of powers of roots. * Discuss about reciprocal equations.	**Unit 05: Polynomial Equations 10 Hrs** Polynomials Properties of Polynomials Equations General Properties of Equations 'Descartes' Rules of Signs Relations between Roots and Coefficients Symmetric Functions of Roots Transformation of Equations Multiple Roots Sum of Powers of Roots Reciprocal Equations
* Define general cubic equation. * Explain about the method of solution of cubic equation byCardon's method with examples. * Clarify the method of solution of cubic equation bysymmetric function of roots.	**Unit 06: Cubic and Biquadratic Equations 12 Hrs** Cubic Equations Algebraic Solutions of Cubic Equations (Cardon'sMethod) Solutions of Cubic Equations by Symmetric

* Define biquadratic equation with examples. * Explain about the method of solution of biquadraticequation by Ferrari's method. * Clarify about the method of solution of biquadraticequation by Euler's method with examples. * Discuss about the method of solution of biquadraticequation by Descartes method. * Solve some related problems.	Function of Roots Biquadratic Equation Solutions of Biquadratic Equations by Ferrari's Method Solutions of Biquadratic Equations by Euler's Method Solutions of Biquadratic Equations by Descartes Method

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. Prescribed Books and References:

i. Linear Algebra – R. M. Shrestha and S. Bajracharya, Sukunda Pustak Bhawan
ii. Algebra – I. N. Hertain
iii. Algebra – Dr. Chandika Prasad, Pothishala Pvt. Ltd.
iv. Algebra – Jeevan Kafle, etc
v. Linear Algebra – S. Lang

FAR WESTERN UNIVERSITY

Faculty of Science and Technology

Course Title: Statistics and Probability **Credit: 3**
Course No: STT121 **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
• 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 commuter software in association with statistics.	**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.
• 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.	**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
• 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	**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

curve, gini-coefficient and also to interpret the result. • Describe the concept and use of skewness and kurtosis (by using partition values, central and raw moments).	their interpretations and use, Measures of skewness and kurtosis, and their use. Computational problems and examples
• 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	**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
• 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 Poissondistributions, • State the normal distribution and its moments, standardization of normally distributed random variable,	**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

□To compute the areas under thenormal curve, □Explain the negative exponential distribution and its moments, and also compute the probability.	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
• 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	**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
• 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.	**Unit VII: Inferential Statistics (8 hrs)** Concept of sampling its types (probability and non probability) with merits and demerits. Steps of sample selection, determination ofsample 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
• To understand and use correlation and regression in information technology • Compute correlation and regression coefficients and interpret the results,	**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.

and also state the properties. • 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.	Computation of partial and multiple correlations and their consistency (up to three variables) Simple linear regression- model and assumptionsof simple linear regression, least square estimatorsof regression coefficients, standard error of estimate, test of significance of regression coefficients, coefficient of determination, and analysis of variance (up to three variables) Computational problems and examples

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 QUILIFIED (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

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- ☐ Aryal, T.R. *Fundamental Statistics- Concepts and Practices*, Viddharthee Publication, Pvt. Ltd., 2010.
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- ☐ 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.
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- ☐ Shrestha, Ganga. *Fundamental of Statistics*. ASAN Publications, Kathmandu,Nepal, 2006
- ☐ Feller, W. *An Introduction to Probability Theory and its Applications*, Vol. 1,

Third edition, JohnWiley 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 IBHPublishing 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 thecourse in the semester.

(iv) Home works and assignments covering the lecture materials will be given throughout the semester.

FAR WESTERN UNIVERSITY

Faculty of Science and Technology

Course Title: Waves and Optics F.M.: 100
Course No.: PHY231 P.M.: 45%
Nature of Course: Theory Credit: 3
Level: B. Sc. Number of hours per week: 3
Year: Second, Semester: Third Teaching Hours: 45

(1). Course Description

The course intends to enable the students to be acquainted with the basic concepts of waves and optics in Physics. Students will be familiarized with the fundamentals of free, damped and forced oscillations, Fourier analysis, wave motion, ultrasonic waves, acoustics, optics and lasers.

(2). Course Objectives:

At the end of this course the students should be able

- ☐ to acquire sufficient basic knowledge in waves and optics
- ☐ to apply this knowledge base for studying major courses in physics
- ☐ to solve mathematical problems in related topics
- ☐ to deduce mathematical equations and formulas

(3). Specific Objectives and Contents:

Specific Objectives	Contents in Detail
• Explain the difference between free and forced oscillation. • Describe free oscillations of systems with one and two degrees of freedom. • Explain superposition principle. • Describe the formation of beats. • Discuss the transverse modes of continuous string. • Explain the general motion of continuous string and its Fourier analysis.	**Unit I: Free Oscillations (8)** Free oscillations of systems with one degree of freedom, Linearity and superposition principle, Free oscillations of systems with two degrees of freedom, Beats, Free oscillations of systems with many degrees of freedom, Transverse modes of continuous string, General motion of continuous string and Fourier analysis
• Understand forced oscillation. • Describe the nature of damped driven one-dimensional harmonic oscillator. • Explain resonances. • Formulate the resonances in system with two degrees of freedom.	**Unit II: Forced Oscillation (4)** Damped driven one-dimensional harmonic oscillator, Resonances in system with two degrees of freedom
• Describe the properties of travelling waves. • Explain and formulate phase velocity and group velocities. • Explain the dispersion relation. • Formulate equations for the phase velocity of sound – Newton's model and explain its correction.	**Unit III: Travelling Waves (5)** Phase velocity and group velocity, Dispersion relation, Phase velocity of Sound, Newton's model and its correction
• Explain the characteristics of ultrasonic waves and its importance. • Describe the production of ultrasonic waves by piezoelectric and magnetostriction methods. • Explain the method for the detection of ultrasonic waves. • Describe the method for measuring the velocity of ultrasonic waves.	**Unit IV: Ultrasonic Waves (5)** Production of ultrasonic waves by piezoelectric and magnetostriction methods, Detection of ultrasonic waves, Velocity of ultrasonic by Sears method
• Explain musical sound and acoustic of buildings. • Understand musical sound and noise. • Explain the characteristics of musical sound. • Define decibel, musical scale and acoustic of buildings. • Derive Sabine's reverberation formula.	**Unit V: Acoustics (3)** Musical sound and acoustic of buildings: musical sound and noise, Characteristics of musical sound, Decibel, Musical scale, Acoustic of buildings, Sabine's reverberation formula
• Explain interference due to the division of wave front and division of amplitude. • Explain the working of Fresnel's biprism, Lloyd's mirror, Newton's ring, Michelson interferometer, Fabry-Perot interferometer and wedge shape. • Derive formulae for the interference.	**Unit VI: Interference (5)** Division of wave front and division of amplitude, Fresnel's biprism, Lloyd's mirror, Newton's ring, Michelson interferometer, Fabry-Perot interferometer, Thin wedge shape interference

• Explain Fresnel and Fraunhofer diffraction. • Explain the working of Zone plate. • Discuss diffraction through single and double slits.	**Unit VII: Diffraction (4)** Fresnel and Fraunhofer diffraction, Zone plate,
• Explain the working of plane diffraction grating. • Obtain expressions for dispersive and resolving power of grating.	Diffraction through single and double slits, Plane diffraction grating, Dispersive and resolving power of grating
• Explain unpolarized, plane, circular and elliptically polarized lights. • Discuss double refraction and the working of Nicol prism. • Explain the working of quarter wave plate and half wave plate. • Describe optical activity and the working of Laurent's half shadepolarimeter.	**Unit VIII: Polarization (6)** Plane, circular and elliptical polarization, Double refraction, Nicol prism, Quarter wave plate and half wave plate, Optical activity, Laurent's half shade polarimeter
• Explain the formation of lasers. • Explain the concept of population inversion. • Describe the working of the ruby laser and the He-Ne laser. • Explain the concept of holography.	**Unit IX: Lasers (5)** Population inversion, The Ruby laser, The He-Ne laser,Holography

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

(4). Evaluation System

Undergraduate Programs							
External Evaluation	**Marks**	**Internal Evaluation**	**Weigh tage**	**Marks**	**Viva-voce**	**Weigh tage**	**Mark**
End semester examination		Assignments	20%		Report and Presentation on any topic	50%	
(Details are given in the separate table at the end)	60	Quizzes	10%	20	Presentation	25%	20
		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 thecourse.

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 assignmentwill 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:

- Crawford Jr F. S., *Waves (Berkeley Physics Course Vol 3)*, Tata McGraw Hill India
- Ghatak A. K., *Optics*, Tata McGraw Hill India

(6). Reference:

- Halliday D., Resnick R. and Walker J., *Principles of Physics*, John Wiley and Sons India
- Subrahmanyam N. and Brij Lal, *Textbook of Optics*, S. Chand and Company, New Delhi

FAR WESTERN UNIVERSITY

Faculty of Science and Technology

Course Title: Physics Practical F.M.: 100
Course No.: PHY231 P.M.: 45%
Nature of Course: Practical Credit: 1
Level: B. Sc. Number of hours per week: 3
Year: Second, Semester: Third Teaching Hours: 45

(1). Course Description

(2). Course Objectives

By the end of the course the student should be able to:

- ☐ measure correctly the basic physical quantities
- ☐ determine errors in measurements
- ☐ analyze raw data and make valid conclusions
- ☐ validate corresponding theoretical component
- ☐ develop proper laboratory skills
- ☐ design basic physics experiments
- ☐ interpret experimental results and draw logical conclusions
- ☐ relate theoretical concepts to practical skills

(3). List of Experiments:

To determine the wavelength of a light source by Newton's Ring method
To determine the wavelength of given source of light using a plane diffraction grating

Note:

Student must perform 6 hours of lab work (2 hours × 3 times or 3 hours × 2 times) every week.
In every semester, at least eight experiments are to be performed. Additional experiments may be added subject toavailability of time.
The practical exam will be graded on the basis of the following marking scheme:

In-semester Evaluation	20%
Final Exam Written	60%
Final Exam Oral	20%

(4). References:

- Arora C. L., *B. Sc. Practical Physics*, S. Chand and Company
- Squires, G. L., *Practical Physics*, Cambridge University Press
- Shukla P. K. and Srivastava A., *Practical Physics*, New Age International (P) Limited Publishers