Far Western University
Mahendranagar, Kanchanpur
Faculty of Science and Technology

B. Sc. Second Semester Biology Group

FAR WESTERN UNIVERSITY
Faculty of Science and Technology

Course Title: English for Communication F.M.: 100
Course No.: C. Eng. 121 P.M.: 45%
Nature of Course: Theory Credit: 3
Level: B. Sc. Number of hours per week: 3
Year: First, Semester: Second Teaching Hours: 48

(1). Course Introduction

This is a compulsory English course for B. Sc. students irrespective of their major subjects. The course exposes the students to the basic communication skills that they require in their day to day academic settings at undergraduate level. The course begins with the four basic skills of language i.e. listening, speaking, reading and writing integrated with the vocabulary and grammar associated with them. Additionally, there is a separate chapter that focuses on the acquisition of the academic vocabulary in use.

(2). Objectives

General objectives of this course are to:

a) develop communicative competence in order to successfully participate in the academic discourse
b) make students critical readers
c) expose students to the varieties of reading text from different disciplines
d) help students develop critical thinking skills
e) expose them to the wealth of academic vocabulary in context
f) help students develop strategies of communication in speaking and writing

(3). Contents in detail with Specific Objectives

Specific Objectives	Contents in Detail
• Listen for main ideas and details • Make inferences • Listen for opinions • Follow a summary • Listen for specific information • Understand figurative expressions to interpret speaker's intention • Listen for signposts to understand the structure of the text • Listening for rhetorical questions to understand the structure of a lecture	**Unit 1: Listening** Listening for gist – skimming Listening for detail understanding Making inferences and forming opinions from listening Summarizing what was listened Listening for comprehension Comprehending figurative expressions and rhetorical expressions in speech
• Participate in a conversation • Make notes to prepare for a presentation or group discussion • Take turns to make conversation go smoothly • Give advice, ask for clarification, express reasons, ask for reasons, ask questions • Lead discussions in group • Prepare dialogues with a partner for various conversations	**Unit 2: Speaking** Engaging in conversation Presentation skills Turn taking Language functions in the academic settings Dialogues and group discussion Leading group discussions
• Use graphic organizers to understand texts • Read and find the central idea of the text • Comprehend different types of texts • Locate specific information in the texts • Identify source of information	**Unit 3: Reading** Using graphic organizers to understand texts Reading for central theme Comprehending different text types Locating specific information in texts Identifying source of information
• Analyze and develop paragraphs of different genres • Plan for writing • Revise, edit and rewrite • Write summaries • Write personal response to the texts • Write different letters • Write different types of essays	**Unit 4: Writing** Analyzing and writing paragraphs Process writing Summary writing Letter writing Responding to the texts in writing Essay writing
• Use the academic vocabulary in professional communication • Select and use academic vocabulary in writing	**Unit 5: Vocabulary** Academic vocabulary Word combinations

assignments • Recall and use appropriate vocabulary in a range of academic discourse • Apply appropriate strategies to enrich their academic vocabulary	Vocabulary at the academic institutions Vocabulary of academic conversation Reading and vocabulary Writing and vocabulary
• Explain ideas and reflect on them • Connect ideas across texts or readings • Relate personal experience to the topic • Blend information from various texts • Evaluate experiences and events	**Unit 6: Critical Thinking** Comparing and contrasting information Connecting ideas across texts or reading Writing with personal reflections and experience Synthesizing information from various sources Evaluating ideas

(4). Evaluation System:

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

(I). External evaluation

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

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

(II). Internal evaluation

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

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

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

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

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

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

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

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

- Lecture and Discussion
- Group work and Individual work
- Self-study
- Assignments
- Presentation by Students

- Term Paper writing
- Quizzes
- Guest Lecture

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

(5). References

1. Daise, D., Norloff, C. and Carne, P. (2011) *Q: Skills for Success (Reading and Writing) – 4*, New York Oxford University Press.
2. Freire, R. and Jones, T. (2011) *Q: Skills for Success (Listening and Speaking) – 4*, New York Oxford University Press.
3. McCarthy, M. and O'Dell, F. (2008) *Academic Vocabulary in Use*, New Delhi Cambridge University Press.

(6). Dictionary

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

FAR WESTERN UNIVERSITY

Faculty of Science and Technology

Course Title: Basic Chemistry II — F.M.: 100
Course No.: CHM121 — P.M.: 45%
Nature of Course: Theory — Credit: 3
Level: B. Sc. — Number of hours per week: 3
Year: First, Semester: Second — Teaching Hours: 45

(1). Course Description

The course intends to enable the students to be acquainted with some aspects of basic concepts of chemistry, in all three branches physical, organic and inorganic chemistry. Students will be familiarized with the fundamentals of equilibrium process, colligative and colloidal properties, ionic and covalent bonds, stereochemistry, substitution and elimination reactions.

(2). Course Objectives:

The general objectives of the course are as follows:

- To acquaint the students with basic concept equilibrium process.
- To enable the students to understand the fundamentals of the colligative and colloidal properties.
- To enable the students to understand the basic concepts of stereochemistry as well as substitution and elimination reactions.
- To acquaint the students with the fundamentals of ionic and covalent bonds.
- 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 law of mass action. • Describe the relationship between K_P and K_C. • State Le Chatelier – Braun principle and describe its applications. • Describe Ostwald's dilution law and its limitations. • Describe pH and pH scale. • Discuss about buffer solution, buffer capacity and buffer range. • Explain the theory of acid base indicator. • Discuss the solubility principle and its applications. • Enable the students to solve numerical problems related to equilibrium, pH, buffer and solubility product principle.	**Unit I: Equilibrium (8)** Law of mass action; Various forms of equilibrium constants; Relation between K_P and K_C; Properties of equilibrium constant; Vant Hoff isotherm; Derivation of thermodynamic equilibrium constant and its relationship with free energy changes under standard conditions; Application of law of mass action and Le Chatelier – Braun principle; Application of Le Chatelier – Braun principle; Strong and weak electrolytes; Ostwald's dilution law and limitations; pH and pH scale; Common ion effects in ionic equilibrium; Buffer solution; Buffer capacity and buffer range, pH change in acid base titration (weak and strong); Theory of acid base indicator; Ostwald's theory, quinonoid theory; Selection of acid base indicators in titrations; Solubility and solubility product principle; Applications of solubility product principle
• Define the term 'colligative property'. • Describe Raoult's law giving examples. • Describe laws of elevation of boiling point and depression of freezing point. • Show how molecular weight of a compound is determined from boiling point elevation. • Discuss abnormalities in solution due to association and dissociation. • Define colloidal state. Show how sols are prepared. • Discuss optical, kinetic and electrical properties of the sols. • Explain electrophoresis, electroosmosis, emulsions and gels. • Enable the students to solve numerical problems related to colligative properties.	**Unit II: Colligative and Colloidal Properties (7)** Solution of nonelectrolytes; Lowering of vapour pressure; Raoult's law; Laws of elevation of boiling point and depression of freezing point; Determination of molecular weight from boiling point elevation; Osmosis and osmotic pressure; Reverse osmosis; Van't Hoff factor; Colligative properties of electrolytes; Abnormalities in solution due to association and dissociation Colloidal dispersions; Lyophilic and lyophobic sols; Sols and preparations; Optical, kinetic and electrical properties of the sols; Electrophoresis and electroosmosis; Emulsions; Gels
Organic Chemistry	

• Explain the basic principle of stereochemistry. • Describe the criteria for a compound to be chiral. • Explain the following terms with examples:	**Unit III: Stereochemistry (6)** Enantiomers and the tetrahedral carbon; Chirality; Optical activity; Pasteur's discovery of enantiomers; Sequence rules for specifying configurations;
tetrahedral carbon, enantiomers, diastereomers, meso compounds and racemic mixture. • Explain the methods for the resolution of racemic mixture. • Describe the reactions involving addition of H_2O to an achiral alkene and a chiral alkene. • Describe chirality of nitrogen, phosphorous and sulphur compounds. • Illustrate and explain prochirality, chirality in nature and chiral environments.	Diastereomers; Meso compounds; Recemic mixture and the resolution of the racemic mixture; Review of isomersm; Addition of H_2O to an achiral alkene; Addition to H_2O to a chiral alkene; Chirality of nitrogen, phosphorous and sulphur; Prochirality; Chirality in nature and chiral environments
• Explain the structures of organohalides. • Explain IUPAC system of naming organohalides. • Describe the different methods of preparation (radical halogenation, allylicbromination, Grignard reagent) of alkyl halides. • Describe organometallic coupling reactions, oxidation and reductions. • Describe the S_N2 reactions in terms of kinetics, mechanism and stereochemistry. • Describe the S_N1 reactions in terms of kinetics, mechanism and stereochemistry. • Describe the E2 reactions in terms of kinetics, mechanism and stereochemistry. • Describe the E1 reactions in terms of kinetics, mechanism and stereochemistry. • Explain biological substitution and elimination reactions.	**Unit IV: Substitution and Eliminations (9)** Organohalides; Nomenclature of organohalides; Structure of alkyl halides; Preparing alkyl halides from alkanes (radical halogenation); Preparing alkyl halides from alkanes (allylicbromination); Stability of the alkyl radicals; Preparing alkyl halides from alcohols; Reactions of alkyl halides (Grignard reaction); Organometallic coupling reactions; Oxidation and reduction Discovery of the nucleophilic reactions; The S_N2 reaction; Characteristics of S_N2 reaction; Steric effects in S_N2 reactions; The role of the nuleophile, leaving group and solvent in S_N2 reactions; the S_N1 reaction; Characteristics of the S_N1 reaction; The role of substrate, leaving group, nucleophile and solvent in S_N1 reactions; Biological substitution reactions; Elimination reactions of alkyl halides (Zaitsev's rule); The E2 reaction and the deuterium effect; The E2 reaction and cyclohexane conformation; The E1 and E1cB reactions; Orientations in elimination reactions (Zaitsev and Hofmann rules); Biological elimination reactions
Inorganic Chemistry	
• Explain the conditions for formation of ionic bonds. • Discuss the properties of ionic bonds. • Explain Born – Lande equation (no derivation required). • Discuss factors affecting lattice energy. • Explain Born – Haber cycle with examples. • Describe polarization and Fazan's rules. • Describe the structures of some selected ionic solids.	**Unit V: Ionic Bond (7)** Ionic bond; Conditions for formation of ionic bonds; Properties of ionic bonds; Ionic crystals; Lattice energy of ionic crystals; Radius ratio rule and its limitations; Born – Lande equation; Factors affecting lattice energy; Born – Haber cycle; Covalent character in ionic compounds; Polarization and Fazan's rules; Effect of polarization – solubility, melting point and thermal stability of ionic compounds; Bond moment and dipole moments; Percentage ionic character; Characteristics of ionic compounds; Structure of ionic solids; Ionic compounds of type AX (NaCl, CsCl, ZnS), AX_2 (CaF_2TiO_2), layer structures, stoichometric and non-stoichometric defects
• Explain the Lewis theory, octet rule and its exception. • Describe different types of hybridization with examples. • Illustrate VSEPR theory with representative examples. • Explain the principle behind hydrogen bonding and metallic bond with examples. • Explain basic ideas of valence bond and molecular orbital theory with examples.	**Unit VI: Covalent Bond (8)** Lewis theory; The octet rule and its exception; Sidgwick Powel theory – prediction of molecular shapes; Sigma and pi bonds; Hybridization (sp, sp^2, sp^3, d^2sp^3, dsp^2, sd^3, dsp^2, dsp^3); Multiple bonding; Three electron bond; Two electron three centered bond; Bond length and bond order; Bond strength; Valence shell electron pair repulsion theory (VSEPR); Shapes of simple inorganic molecules and ions containing bonds and lone pairs (NH_3, SF_4, BO_3^{3-}, NH_4^+, ClF_3, ICl_4^-, ICl_2^-, PCl_5, XeF_4, XeF_6); Hydrogen bond (theories of hydrogen bonding, valence bond treatment); Metallic bond (free electron theory and bond theory); Conductors, insulators and semiconductors; Elementary idea of L.C.A.O. and concept of united atoms in molecular orbital theory; Bonding, antibonding and non-bonding orbitals; M.O. configurations of simple diatomic molecules (H_2, He_2, N_2, O_2, F_2, CO, NO, HCl)

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

(4). Evaluation System

Undergraduate Programs							
External Evaluation	**Marks**	**Internal Evaluation**	**Weightage**	**Marks**	**Viva-voce**	**Weightage**	**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 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

Course Title:
BIOCHEMISTRY
Nature of the Course: **Theory**
Course No.: **MIB121**
Level: **B. Sc.**

Credit: **3**
Total hours: **45**
Semester**: Second**

1. Course Description

The course intends to enable the students to be acquainted with the general human biochemistry and cellular functions of prokaryotes. The aim of the course is to provide fundamental knowledge on Structure and Properties and biological functions of amino acids, Proteins, Carbohydrates and Lipids and to enable them to perform biochemical investigations using instrumentation ,

.Course Objectives

After the completion of the course the students will be able to understand
the end of this course, students will be able to understand:

- Biochemical explanation of life, Structures and functions of biomolecules, cellular metabolism and genetics
- Principles and applications of instrumentation techniques in biochemical analysis

2. Specific Objectives and Contents

Specific Objectives	Contents
	Unit I:
	Basic concept of life: (2)
• To discuss Biochemical explanation of life, Cellular organization of prokaryotes and eukaryotes	Biochemical explanation of life, Cellular organization of prokaryotes and eukaryotes, Water as the universal solvent for life, Biological Buffers
	Unit II:
	Biomolecules: (15)
• To describe the Classification, Structure, Properties and biological functions of amino acids, Proteins, Carbohydrates and Lipids	Classification, Structure and Properties and biological functions of amino acids, Proteins, Carbohydrates and Lipids

• To explain enzyme Nomenclature and classification system. • To discuss biological role and functions of enzymes. • To describe fundamentals of enzyme kinetics	**Unit III:** **Enzymes: (3)** Nomenclature, classification and functions of enzymes. Coenzymes, cofactor and isozymes, Enzymes Kinetics,
•Explain the biological functions of vitamins and hormones •To explain Process, biochemistry and biological significance of Carbohydrate, protein and lipid Metabolism in human and in prokaryotic organism	**Unit IV:** **Vitamins and Hormones: (5)** Types, structure and biological functions of vitamins and hormones **Unit V: Microbial metabolism (5)** Concept of Microbial energetic, Process and biological significance of Carbohydrate Metabolism –Glycolysis, citric acid cycle, electron transport chain, Lipid metabolism and Protein Metabolism in prokaryotes and in human
• Explain Structure, types and functions of RNA and DNA • to describe Nucleosides and nucleotides, genetic code • To discuss process and significance of transcription and translation and explain regulation of gene expressions, • Explain the prokaryotic genome, genetic code, plasmids, • To describe bacterial recombination	**Unit VI:** **Nucleic acid and Microbial genetics: (5)** Structure, types and functions of RNA and DNA, Replication of DNA, Transcription, Translation, regulation of gene expressions, genetic code
• To describe Classification, Reproduction and life cycle of common Yeast and Mold •To explain Structure, Lifecycle and General properties of medically important Protozoan and Helminthic parasites	**Unit VII:** **Instrumentation for Biochemical analysis (10)** Working principles and applications of chromatography, electrophoresis, spectrophotometry and centrifugation

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

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

3. 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.

4. 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 askedcovering 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.

5. Reference book for Microb 102 Theory and Microb 102 practical

1. Lehninger, A. L., Nelson, D. L. and Cox, M. M. (2000). **Principles of Biochemistry**. 3rd Edition (Freeman Publishers), New York
2. Plummer, D. T. (1988). **An Introduction to Practical Biochemistry**. 3rd Edition. Tata McGraw Hill, New Delhi
3. Wilson, K and Walker, J. (1994)**. Practical Biochemistry**, Cambridge University press, England.
4. Elliott W.H., Elliott D.C., **Biochemistry and Molecular Biology**4rd Edition, Oxford University press, New Delhi

Far-Western University
Faculty of Science and Technology

Course Title: B **iochemistry practical** Credit: **1**
Course No.: **MIB121** Number of hours per week:
Nature of the Course: **Practical** Total hours: 15
Year: **First**, Semester**: second**
Level: **B.Sc.**

- Preparation of Percentage, Molar, Normal, ppm (Part per million) solutions
- Preparation of acetate, phosphate and citrate buffer of different pH, Measurement of pH by pH meter and indicators
- Qualitative analysis of carbohydrates (mono-, di- and polysaccharides)
- Quantitative estimation of reducing sugars
- Qualitative analysis of lipids and fatty acids
- Determination of acid value, Saponification value, iodine number
- Qualitative and quantitative estimation of amino acids and protein
- Ninhydrin test, Biuret test, Xanthoproteic test, Caesin estimation in milk, Protein precipation
- Separation of amino acids by paper chromatography, Separation and identification of sugars, amino acids and lipids by thin layer chromatography (TLC)
- Protein estimation by Folin-lowrey method
- Extraction, purification and estimation of amylase and protease enzymes of bacteria

Far-Western University
Faculty of Science and Technology

Course Title: Environmental Aspects of Meteorology and Hydrology

Course No.: ENV121

Nature of the Course: Theory **Total Credit: 3**

Level: B. Sc. **Instruction hours/week: 3**

(Undergraduate) Year: First

Semester: Second

1. Course Description

The aim of the course is to provide knowledge on Hydro- Meteorology, Climatology, and Limnology. The course has been divided into four units. The first unit familiarizes the students about limnology and its application. Second unit deals with concept and principles of Environmental Hydrology and its application. Third and fourth unit give emphasis on aspect of Meteorology and climatology and their implication in environmental science.

2. Course Objectives

The objectives of the course are as follows:

- To enhance students understanding on broader aspects of environmental Science linking it with limnology, hydrology, climatology and meteorology to develop analytical skills.
- To make students familiar with scope and application of Limnology.
- To familiarize the students with the importance and application of hydrology.
- To aquatint the students with principles and process of Climatology and Meteorology.
- To familiarize the students about climate and climatic systems.

3. Specific Objectives and Contents

Specific Objectives	Contents
• Provide knowledge on concept, Scope and importance of Limnology. • Discuss about Physico-Chemical and Biological Characteristics of water. • Describe on conservation aspects and ecosystem services of wetlands.	**Unit 1: Limnology** **10 hrs** Introduction: Scope and Application; Fresh water Environment: Defination, Types,and limiting factors; Characteristics of lotic and lentic environment; Morphometry of Fresh water body; Physico - Chemical properties; Physico Chemical and Biological water quality index; Fresh water biodiversity;

	Wetlands: Concept, Types, Roles, Threats, Challenges and Conservation with focus to Nepal; Fresh Water habitat degradation; Ecosystem Services of aquatic ecosystem :case studies; Concept of water footprints, Ecological and economic importance of freshwater environment.
• Provide Knowledge about hydrological cycle, Global water budget and Nepal's water budget. • Discuss about precipitation, types and forms and its measurement techniques. • Explain about basin characteristics, drainage patterns, runoff and its components. • Provide knowledge on stream flow measurement. • Discuss about sedimentation process, its estimation and sedimentation problems in Nepal. • Describe about floods, its causes, measurement and forecasting techniques. • Highlight about concept of hydrogeology.	**Unit-2:Environmental-Hydrology 20hrs** Environmental Science and Hydrology: Definition and scope; hydrological cycle; global water budget; Nepal's water budget; Precipitation : Forms, measurement of precipitation: recording and non-recording rain gauges; analysis and interpretation of rainfall data; estimation of missing precipitation records; mass rainfall curve and hyetograph; intensity duration of rainfall; basin characteristics; drainage patterns; runoff: surface, subsurface and direct runoff, factors affecting runoff, Stream flow: components of runoff, factor affecting runoff, stream flow measurement and stage-discharge relationship; discharge measurement; hydrographs; evaporation, evapo-transpiration and infiltration: measurement and estimate, factor affecting evaporation, evapo-transpiration and infiltration, Sedimentation: Introduction and sources of sediment, factors affecting sediment yield, control measures, sedimentation problems in Nepal, Floods: causes, factor affecting and types; flood flow determination; Flood measurements: frequency analysis, reconstruction of hydrological data, control techniques and forecasting; hydrogeology: porosity, permeability, specific yield, specific retention, water table, aquifer, ground water flow measurement: Darcy's law.

• Discuss about Earth-Sun relationship, factors affecting the receipt of insolation by earth. • Estimation and of radiation and heat budget. • Explain about temperature, pressure, wind, general atmospheric circulation and their components. • Discuss about different types and forms of precipitations. • Provide Knowledge on meteorological principle to transport and diffusion of pollutants. • Explain; wind roses; lapse rate and temperature inversion; scavenging process.	**Unit 3: Principles of Meteorological Fundamentals 8 hrs** Earth-Sun relationship; factors affecting the receipt of insolation by earth; radiation and heat budget; Insolation and factors affecting distribution of insolation; temperature: records, distribution, air temperature and its measurement; pressure: atmospheric pressure, pressure –height relationship, pressure distribution; air pressure and wind; wind: direction and speed; factors affecting wind; local wind systems; general atmospheric circulation and jet stream; thermal circulation; humidity: definition(absolute and relative), precipitation: general processes, Forms and types; atmospheric stability; stable, unstable and neutral atmosphere; turbulence and diffusion; meteorological principle to transport and diffusion of pollutants; wind roses; lapse rate and temperature inversion; scavenging process.
• Provide knowledge on concept, Scope and importance of climatology. • Discuss about weather and climate and its elements. • Describe climatic classification and climate types. • Explain about climate and seasons of Nepal and climatic factors affecting human settlement and livelihood. • Explain the meaning and concept of Dendro-Climatology and its application. • Explain about climate and climatic hazards.	**Unit 4: Climatology 10 hrs** Climatology: Introduction, importance and types; composition and structure of the atmosphere; weather and climate; factors determining climate; microclimate; elements of weather and climate World climate and climatic systems; climatic classification; objectives and basis; koppen's, Thornwaite classification; climate types: tropical climate, temperate climate, highland climate, tundra climate; climate and seasons of Nepal; monsoon and its environmental significance; monsoon of Nepal; rainfall and temperature variation with east-west, north south, intraregional variation in Nepal; climatic factors affecting human settlement and livelihood in Nepal, concept of dendro-climatology. Climate and climatic hazards: drought; flood; climate and food security; thunderstorms, tornadoes, hurricanes and EL- Nino/ ENSO

Text Books :

1. Adoni, A.D. A text book of Limnology, Prathibha Publishers, Sagar.

2. Critchfield, H.J. *General Climatology*
3. Reddy, J.P. 2011, *A Text Book of Hydrology*, 3rd edition, Laxmi Publication, New Delhi.

4. Subramanya, K, 2002, *Engineering Hydrology*, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, India.

References:

1. Critchfield, H.J. *General Climatology*
2. Grag, S.K. 2000, *Hydrology and Water Resources*, Khanna Publishers, Delhi.
3. Hewlett, J.D. 1982, *Prince of Forest Hydrology*, University of Georgia Press, Athens, Georgia.
5. Kohler, L. and Paulhus, 1992, *Applied Hydrology*, Tata McGraw-Hill Publishing Company Ltd., New Delhi, India.

6. Frey, D.G. and Fry, F.E.J. Fundamentals of Limnology. TorontoUniversity Press, Canada.

7. Lockwood, J.G. *World Climatology*

8. Reddy, J.P. 2000, *A Text Book of Hydrology*, Laxmi Publication, New Delhi.

9. Suresh, R.1997, *Watershed Hydrology*, Standards Publishers and Distributors, Delhi.

10. Burkhard von Rabenau, 1993, *Project Financial Analysis for Physical Planners*, GTZ/DHUD/MHP, Kathmandu/Nepal and Columbus, Ohio/ USA

11. WECS 2002. *Water Resources Strategy Nepal,* Water and Energy Commission Secretariat, Kathmandu, Nepal.

12. Cunningham, W.P & Cunningham, M.A. (2004). *Principles of Environmental Science: Inquiry and Applications,* Second Edition. Boston: Mc Grow Hill.

13. Mather J. R, Water Resources, distribution, use and management, wiley, New York.

Course Title: Environmental aspects Of Meteorology and Hydrology
Total Credit: 1
Course No: -Env121
Year: First
Semester: Second
Nature of Course: Practical

Practical No.

1. Study of macrophytes and macro invertebrates communities from lentic and lotic environment (sampling methods, sampling sites, density distribution, composition and diversity)
2. Qualitative and quantitative estimation of phytoplankton and Zooplankton.
3. Determination of Temperature, pH, turbidity, conductivity, Dissolved Oxygen, Hardness, alkalinity, chloride, phosphate and Nitrogen.
4. Measurement of river discharge (float method, current meter method weir and bucket method)
5. Estimation of optimum number of rain gauge stations.
6. Estimation of missing precipitation data.
7. Analysis of flood frequency and estimate extreme flood events.
8. Study of infiltration of water through soil curve.
9. Estimation of potential evapo- transpiration.
10. Construction of Hydrograph, unit hydrograph, base flow and rating curve.
11. Field observation of agro-meteorological and hydro- meteorological stations
12. Analysis of weather parameters (temperature, precipitation, humidity)
13. Estimation of missing weather data (temperature, precipitation and humidity)
14. Study on classification of temperature and precipitation zones of Nepal.
15. Wind rose Construction.

Some major points related to aforementioned practical:

1. Students have to carry out *one day field visit* to nearby lentic and lotic ecosystem for conducting practical number **1, 2, and 11**. 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 for practical no. **11** and submit during practical examination.

3. Students have to submit a field note book of all field visits during practical examination.

FAR WESTERN UNIVERSITY

Faculty of Science and Technology

Course Title: Computer Programming F.M.: 100
Course No.: CSC121 P.M.: 45%
Nature of Course: Theory + Lab Credit: 3+1
Level: B. Sc. Number of hours per week: 3+3
Year: First, Semester: Second Total Hours: 45

1. Course Introduction

This course aims to introduce students to the discipline of computing with good program design, programming styles and structured programming language C. The course provides fundamental knowledge of C programming.

2. Objectives

- To develop a programming logic.
- To write algorithm and draw flow chart for the problem.
- To teach basic principles of programming.
- To develop skills for writing programs using 'C'.

3. Specific Objectives and Detailed Course Contents:

Specific Objectives	Contents
○ Define computer program. ○ Describe different notations of algorithms. ○ Develop algorithms and flowcharts. ○ Differentiate between POPs and OOPs. ○ Describe program development life cycle.	**Unit 1: Problem Solving Using Computers (5 hrs)** Program and Programming languages Generations of programming languages. Language Processors: Interpreters ,compilers and Linkers Programming Approaches: procedural and object oriented Problem Analysis Algorithm development and Flowcharting Writing pseudo codes Program development Life Cycle
○ Understand structure of C program. ○ Writing simple C programs. ○ Understand basic C tokens. ○ Write and execute C programs. ○ List out header files ○ Define keywords. ○ Input different types of data and produce output in desired form.	**Unit 2 : Fundamentals of C Programming (7 hrs)** Introduction and History of C Structure of C program, compilation and execution of program Character Set, keywords, identifiers Data types Variables, definition and declaration, constants. Escape sequences, preprocessor directives, header files Expressions, Statements, Comments, Symbolic constants. Input and Output in C(formatted and unformatted functions)
○ Write programs using C operators. ○ Understand and write type conversion and casting. ○ Understand precedence of operators.	**Unit 3 : Operators and Expression (3 hrs)** Arithmetic operators Increment operator, decrement operator Relational operators, Logical operators ,Assignment operator (=) Conditional operator (? :), Bitwise operators , Comma operator Precedence and Associativity of operators Arithmetic expressions Type conversion in expressions

○ Understand selection, looping and jumping statements in C. ○ Alter the sequence of program execution.	**Unit 4: Control Statements** **(6 hrs)** Introduction to Control Statements(selective, iterative) Selection: If , If else , Nested if-else , Else if ladder, Switch Looping statements: while, do while and for loops Break statement, Continue statement, Goto statement
○ Understand function and is needs. ○ Define and implement function in programs. ○ Understands macros. ○ Declare function prototype. ○ Understand scope and storage class.	**Unit 5: Functions** **(6 hrs)** Introduction to Functions User defined and Library functions Components of Function Call by value and Call by reference Scope of variable, storage classes, macros Recursive function
○ Understand needs of arrays. ○ Understands to define and implement arrays. ○ Understands sorting and searching techniques. ○ Understands strings	**Unit 6: Arrays and Strings** **(5 hrs)** introduction : Array, Accessing array elements Single and multi dimensional array Sorting and searching(bubble sort, sequential and binary) Arrays and functions String and String handling functions
○ Define and declare structures ○ Be able to understand the relationship between arrays and structures ○ Be able to define structures within structures	**Unit 7: Structures and Unions** **(4 hrs)** Defining structures, processing structures, array of structures User defined Type(typedef), Array within structures Passing structures to function Structures within structures Union
○ Understands pointers and its declarations. ○ Understands pointer operations. ○ Understands dynamic memory allocations	**Unit 8: Pointers** **(4 hrs)** Declaration ,initialization and Uses of pointers Pointer Operations Array of pointers Pointers and 1-D and 2-D Arrays Dynamic memory allocation
○ Understands file handling in C ○ Read and write data to or from file.	**Unit 9: File Handling** **(3 hrs)** File types, files opening and closing ,file opening modes File functions for Reading/Writing from / to a file Random Access file
○ Understand built in graphics functions ○ Write simple graphics programs.	**Unit 10 : Graphics** **(2 hrs)** Introduction Initialization and graphics mode Simple program using built in functions

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				

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 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.

5. Text and Reference Books:

- Introduction to Algorithms (Second Edition): *Cormen*, Leiserson, Rivest, Stein, PHI (Chapter 1, 2, 3, 10).
- Programming in ANSI C (Third Edition) : E Balguruswamy TMH (Chapters 2 to 13)
- Fundamental Algorithms (Art of Computer Programming Vol. I: Knuth Narosa Publishing House.
- Algorithms in C (Third Edition): Robert Sedgewick, Pearson Education Asia.
- Let us C by Yashwant Kanetkar, BPB
- Programming in ANSI C by Ram Kumar, Rakesh Agrawal, TMH
- Programming with C (Second Edition): Byron S. Gottfried. (Adapted by Jitender Kumar Chhabra) Schaum's Outlines (TMH)
- Programming with C: K.R. Venugopal, Sudeep R. Prasad TMH Outline Series.
- Deitel, C.: **How to Program**, 2/e (With CD), Pearson Education.
- Byron S. Gottefried, " *Theory and Problems of Programming with C*", Mc-Graw Hill.

Laboratory Work Guidelines:

Students will have to complete the assigned practical work throughout the semester and Practical

This course requires a lot of programming practices. Each topic must be followed by a practical session. Practical sessions for each unit should be conducted and should include writing the C-programs. The instructors are highly encouraged to prepare lab sheets for individual units covering the mathematical problems as per the requirement. The sample lab sessions can be as following descriptions,

Assignment List for Lab Work

All the students will have to complete the following set of programming. Lab in-charge may assign additional assignment depending upon the time available.

1. Assignment to demonstrate use of data types, simple operators (expressions)
2. Assignment to demonstrate decision making statements (if and if-else, nested structures)
3. Assignment to demonstrate decision making statements (switch case)
4. Assignment to demonstrate use of simple loops
5. Assignment to demonstrate use of nested loops
6. Assignment to demonstrate menu driven programs.
7. Assignment to demonstrate writing C programs in modular way (use of user defined functions)
8. Assignment to demonstrate recursive functions.
9. Assignment to demonstrate use of arrays (1-d arrays) and functions
10. Assignment to demonstrate use of multidimensional array(2-d arrays) and functions
11. Assignment to demonstrate use of pointers
12. Assignment to demonstrate concept of strings (string & pointers)
13. Assignment to demonstrate array of strings.
14. Assignment to demonstrate use of bitwise operators.

15. Assignment to demonstrate structures (using array and functions)
16. Assignment to demonstrate structures and unions
17. Assignment to demonstrate command line arguments and pre-processor directives.
18. Assignment to demonstrate file handling (text files)
19. Assignment to demonstrate file handling (binary files and random access to files)
20. Assignment to demonstrate graphics using C

Far-Western University
Faculty of Science and Technology

Nature of the Course: **Theory**
Course No.: **Zoo 121**
Level: **B. Sc.**
Year: **First**

Credit: **3**
Total hours: **45**
Semester**: Second**

Course Title: Animal Diversity: Higher non- chordata and Protochordata

1. Course Description

The course intends to enable the students to be acquainted with the basic concepts of classification, basic structures and functions of higher invertebrate and protochordate organisms.

2. Course Objectives:

The general objectives of the courses are as follows.

- Classify the higher non-chordates and Protochordates up to order with their examples.
- Know the functional anatomy and important phenomena of typical representative/s of each Phylum.
- Describe the social life, metamorphosis and mouth parts of insects, torsion and foot in mollusc and symmetry in Echinodermates.

3. Courses Contents

Specific objectives	Contents
• Describe general characters and outlines classification of higher nonchordates and protochordates.	**1. Systematics (10)** Higher non chordates- General characters and classification of the Arthropoda, Mollusca and Echinodermata up to orders with examples showing distinctive / adaptive features. Protochordates- General characters and classification of the Protochordates up to orders with examples showing distinctive / adaptive features.
• Understand structure and organ systems of the *Palaemon*, • Describe importance of *Limulus* • Give overviews of social life	**2. Arthropoda (15)** *Palaemon:* structure and organ systems. Zoological importance of *Limulus* Social life of honey bee Parasitic Arthropoda 2.5. Overview of diseases vectors (*Culex* spp, *Anopheles* spp and

in honey bee, common parasitic and vectors insects. • Describe metamorphosis and mouth parts of insects and crustacean larva.	*Phlebotomus* spp) Metamorphosis in insects Larval forms of Crustacea Mouth parts of Insects
• Describe structure and organ systems of *Pila* • Understand the phenomenon of torsion, foot modification and shell structures of Mollusca.	**3. Mollusca (08)** *Pila:* structure, organ systems and development Torsion and detorsion in gastropods Modification of foot in Molluscs Shell structure Utility of molluscs in food and ornaments.
• Describe structure of *Asterias*. • Describe symmetry and larval forms of Echinodermates.	**4. Echinodermata (05)** *Asterias*: structure with special reference to water vascular system 4.2 Symmetry of Echinodermata 4.3. Larval forms of Echinoderms and their evolutionary significance
• Discuss structure, organ systems and affinities of protochordates.	**5. Protochordates (07)** Structure, organ systems, development and affinities of Balanoglossus, herdmania and Branchiostoma

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

Undergraduate Programs							
External Evaluation	**Marks**	**Internal Evaluation**	**Weightage**	**Marks**	**Practical**	**Weightage**	**Mark**
End semester examination		Assignments & Presentation	20%		Practical Report copy	25%	
(Details are given in the separate table at the end)	60	Quizzes	10%		Viva	25%	
		Attendance	20%		Practical Exam	50%	
		Internal Exams	50%	20			20
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.

6. Recommended Books:

1. **Barnes, R. D.** 1981. Invertebrate Zoology.Saunders College Publ.

2. **Barnes, R. B., R.S.K. & Calow, P. P.** 2001. The Invertebrates: A Synthesis. Wiley-Blackwell.

3. **Barrington**: Invertebrate Structure and Function (Nelson)

4. **Kotpal, Agarwal and Khetrapal**: Modern Textbook of Zoology: Invertebrate, (Rastogi)

5. **Kotpal, Agarwal and Khetrapal**: Modern Textbook of Zoology: Vertebrate, (Rastogi)

7. **Marshall: Parker and Haswell**. Textbook of Zoology, Vol.I (A.Z.T.B.S. Publishers & Distributors. New Delhi).

8. **Marshall: Parker and Haswell**. Textbook of Zoology, Vol. II (A.Z.T.B.S. Publishers & Distributors. New Delhi).

9. **Jordon and Verma**: Invertebrate Zoology (S. Chand)

9. **Hickman, Hickman &Roberts**. Integrated principles of zoology, Mosby college publication. St. Louis.

10. **Ruppert, E. E., R. S. Fox, and R. D. Barnes** (2004). Invertebrate Zoology, 7th ed., Thompson Brooks/Cole Publ

11. **Anderson, D. T.**. 2006. Invertebrate Zoology. Oxford Univ. Press.

12. **Brown, F. A.** 2002. Invertebrates.Daya Publishing House.

13. **Brusca, R.C. & Brusca, G.J.** 2003. Invertebrates. Sinauer Associates, Inc.

14. **Buchsbaum, R., Buchsbaum, M., Pearse, J. & Pearse, V.** 1987. Animals without backbones: An Introduction to the Invertebrates. 3rd edition.University of Chicago Press.

15. **Meglitsch P. A. & Schram, F. R.** 1991. Invertebrate Zoology.Oxford Univ. Press.

16. **Miller, S. A. & Harley, J. P**. 2006. Zoology, 7th Edition.McGraw Hill International.

17. **Moore, Janet.** 2006. An Introduction to the Invertebrates. Cambridge University Press.

18. **Pechenik, J. A.** 2005. Biology of the Invertebrates. Tata McGraw Hill Publ.

19. **Ruppert, E.E. & Barnes, R.D.**1994, Invertebrate Zoology. Harcourt Asia Pvt. Ltd.

20. **Ruppert, E. E., Fox, R. S. & Barnes, R. D.** 2009. Invertebrate Zoology: A Functional Evolutionary Approach. 7th edition.Thomson Brooks/Cole.

21. **Jordon and Verma**: Vertebrate Zoology (S. Chand)

Far-Western University
Faculty of Science and Technology

Course No.: **Zoo 121**
Nature of the Course: **Practical**
Year: **First**,
Semester**: Second**
Level: **B. Sc.**

Credit: 1
No. periods/ week:

Course Title: Animal Diversity: Higher non- chordate and Protochordates

1. Course Description

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

2. Course Objectives:

The general objectives of the courses are as follows.

- Identify the important representatives of higher non-chordate phyla and protochordates.
- Know the histology of different organs of higher non-chordates and protochordates.
- Learn general anatomy of different non- chordates.

3. Course Contents:

3. 1. Animal Diversity

Study of salient features and classification up to classes of the higher non-chordates with special emphasis on their adaptive characters: Study the typical representative of animal types (museum specimens).

Levels of organization in Animal kingdom

Segmentation

iii) Specialization of body parts for division of labour: Head, thorax and abdomen - Insect

Cephalization i) Cockroach – Head

ii) Prawn/crab – Cephalothorax

Faunal Survey and Report Writing

Faunal survey of any locality and writing a report on the collected/studied fauna

Study of slides/charts of the following:

Crustacean larvae

Insect larvae

Echinoderm larvae

Study of Permanent (Histological) slides.

Palaemon - sections, *Unio* and *Pila* – Gill sections; *Balanoglossus*, *Herdmania* and *Amphioxus* – their sections of different regions.

3.6Permanent Mounting (Permanent Slide Preparations)

Mosquito larva, mouth-parts of the insects available in the locality, *Daphnia*, *Cyclops*, *Cypris*, Statocyst of prawn, hind leg of honeybee, radula of *Pila*, , etc

3.7. Dissection.

Prawn/Cockroach - Appendages, Nervous system and Digestive organs.

Honeybee - General Anatomy, Digestive organs, Nervous system, Sting.

Pila (apple snail) – General anatomy and Nervous system.

4. Scheme of Evaluation

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

Dissection = **35 %**

Temporary mount **= 10 %**

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

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

Viva voce =**10 %**

Class records = **10 %**

5. Recommended books

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

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

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