

# NATIONAL UNIVERSITY



## Second Year Syllabus Department of Zoology

Four Year B.Sc. Honours Course  
Effective from the Session: 2013–2014

# National University

Syllabus for Four Year B.Sc. Honours Course

Subject: Zoology

Effective from the Session: 2013-2014

Year-wise Papers and marks distribution

## SECOND YEAR

Paper Code	Paper Title	Marks	Credits
223101	Animal Diversity –II: Lower chordates and Chordates	100	4
223103	Comparative Anatomy: Protozoa, Non-chordates and Chordates	100	4
223105	Environmental Biology	100	4
223106	Zoology Practical -II	100	4
	<b>Any two of the following:</b>		
223007	Botany-II	100	4
223008		50	2
222807	General Chemistry-II	100	4
222809		50	2
	Or		
222909	Biochemistry-II	100	4
222910		50	2
	Total =	700	28
221109	English (Non-Credit)	100	Non-Credit

## Detailed Syllabus

<b>Paper Code</b>	223101	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60 hrs.</b>
<b>Paper Title</b>	<b>Animal Diversity –II: Lower chordates and Chordates</b>			

1. **Broad classification of the following up to orders with general and diagnostic characteristics of each taxon with examples and affinities:** Urochordata, Cephalochordata, Myxini, Cephalaspidomorpha, Chondrichthyes, Osteichthyes, Amphibia, Reptilia, Aves and Mammalia.
  
2. **Type study of the following with their systematic position, habitats and external morphology; anatomy including skeletal, digestive, circulatory, respiratory, excretory, nervous, reproductive and endocrine systems; food and feeding habits; mode of life and development:**
  - a) Urochordata: *Ascidia*
  - b) Cephalochordata: *Branchiostoma*
  - c) Myxini: *Myxine*
  - d) Cephalaspidomorpha: *Petromyzon*
  - e) Chondrichthyes: *Scoliodon*
  - f) Osteichthyes: *Labeo rohita*
  - g) Amphibia: *Bufo*
  - h) Reptilia: *Hemidactylus*
  - i) Aves: *Columba livia*
  - j) Mammalia: *Homo sapiens*.
  
3. **Brief notes on the following –**
  - a) Chondrichthyes: Sharks, skates and rays.
  - b) Osteichthyes: Lungfishes including *Latimeria*, exotic fishes.
  - c) Amphibia: Anurans, caecilians, salamanders and newts.
  - d) Reptilia: *Sphenodon*, dinosaurs.
  - e) Aves: *Archaeopteryx*, migration, flightless birds.
  - f) Mammalia: Aquatic mammals, egg-laying mammals, marsupials, apes, Bengal Tiger.

### Books Recommended

1. J. Young. 1981. *Life of Vertebrates*. OUP, USA.
2. F.H. Pough, J.B. Heiser and W.N. McFarland 1997. *Vertebrate Life*. Prentice Hall.
3. R.M. Alexander 1997. *The Chordates*. Vikas Publishing House, New Delhi.

<b>Paper Code</b>	223103	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60 hrs.</b>
<b>Paper Title</b>	<b>Comparative Anatomy: Protozoa, Non-chordates and Chordates</b>			

### Protozoa & Non-Chordates:

**(50 Marks)**

1. **Protozoa:** Body covering and skeletal structure, locomotory organelles and locomotion, reproduction, parasitism. Nuclear apparatus and nutrition.
2. **Porifera:** Body wall and cell types, skeletal structures, canal systems.

3. **Coelenterata:** Polymorphism and metagenesis, corals, coral reef. Reef formation, and theories.
4. **Platyhelminthes:** Parasitic adaptations, hold fast organs.
5. **Annelida:** Asexual reproduction of Polychaeta, segmental organs.
6. **Arthropoda:** Crustacean larvae, respiratory organs
7. **Mollusca:** Shell and its formation, foot and its modification.
8. **Echinodermata:** Symmetry of Echinoderms. Larval forms.

**Chordates: (50 Marks)**

1. **Integument and its derivatives:** Epidermal glands, fish fins and scales; feathers, beaks, bills and claws of birds; nails, hooves and horns of mammals; dentition, types of dentition, dental formula.
2. **Skeletal system:** Axial and appendicular skeleton.
3. **Circulatory system:** Modification of aortic arches and heart in reptiles, birds and mammals.
4. **Nervous system:** Brain and cranial nerves.
5. **Urogenital system:** Excretory system: pro-, meso- and metanephric kidneys; reproductive system

**Books Recommended**

1. P. Wilmer 1990. *Invertebrate Relationship: Patterns in Animal Evolution*. CUP, USA.
2. C. Starr and R. Taggart 1981. *Biology: The Unity and Diversity of Life*. Wadsworth Publ. Co., California, USA.
3. E.E. Rupert and R.D. Barnes 1994. *Invertebrate Zoology*. Saunders College Publ., New York, London.
4. K.V. Kardong 1997. *Vertebrates: Comparative Anatomy, Function, Evolution*. W.M.C. Brown, USA.
5. D. Webster and M. Webster 1974. *Comparative Vertebrate Morphology*. Academic Press, New York.
6. G.C. Kent and L. Miller 1997. *Comparative Anatomy of the Vertebrates*. McGraw Hill.

<b>Paper Code</b>	223105	<b>Marks:100</b>	<b>Credits: 4</b>	<b>Class Hours: 60 hrs.</b>
<b>Paper Title</b>	<b>Environmental Biology</b>			

1. **Environment:** Introduction, components of environment, factors affecting environment, environmental management, environment and health, biology, segments of environment – atmosphere, hydrosphere, lithosphere and biosphere.
2. **Pollution and Pollutants:** Pollution, environmental pollution, pollutant, classification of pollutants, types of pollution.

3. **Air Pollution:** Introduction, air quality, major sources of air pollution, gaseous pollutants, acid rain, how acid rain is formed, adverse effects of acid rain, greenhouse effect- how the greenhouse effect is produced, consequences of greenhouse effect and global warming. EL Nino and La-Nina phenomenon and its effect, ozone depletion, mechanism of ozone depletion, effects of ozone depletion.
4. **Water Pollution:** Introduction, classification of water pollutants, physical, chemical and biological characteristics of wastewater, industrial wastewater treatment, municipal water treatment, water quality parameters and standards.
5. **Sound pollution:** Sources, effects and prevention.
6. Eutricatiion Sewerage disposal, garbage and waste management including hospital wastages.
7. Disaster management: Earthquake, flood, cyclone, tidal surges, tsunami, saline water intrusion, drought, river erosion and siltation with particular reference to Bangladesh.
8. Environmental management development planning and environment Impact assessment (EIA). Salient Features of the Bangladesh Environment Conservation Act 1995, and Bangladesh Conservation Rules 1997.

**Books Recommended:**

1. Environmental Chemistry, B.K. Sharma, Goel Publishing House.
2. Environmental Chemistry, AK. Dev, New Age International Publishers.
3. Environmental Chemistry, S.E. Manahan, CRC Press.
4. A Textbook of Environmental Chemistry and Pollution Control, S.S. Bara S. Chand & Company Ltd.

<b>Paper Code</b>	223106	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60 hrs.</b>
<b>Paper Title</b>	<b>Zoology Practical – II</b>			

1. **Study of museum specimens:** Representatives of all types of chordates with reference to Bangladesh (at least 50 specimens to be studied).
2. **Study of bones:** Comparative study of the skeleton of an amphibian, a reptile, a bird and a mammal.
3. **Dissection:** Dissection of the following specimens:  
**Major dissection:**
  - a) Any carp – brain and cranial nerves
  - b) Lizard – circulatory system
  - c) Chicken/Pigeon – air sacs**Minor dissection:**
  - a) Lata fish- afferent and efferent blood vessels
  - b) Eye muscle of carp/dog fish.
4. **Temporary mounting:** Scales and Weberian ossicle of fishes.
5. **Freshwater studies:** Identification of plankton and benthic micro fauna in freshwater samples.
6. **Study of permanent slides:** Whole mount, embryological stages and histological slides (at least 20 slides to be studied).

### Distribution of Marks for Second Year Final Practical Examination

No.	Particulars	Marks
1.	Major dissection (dissection 7 + display 2 + drawing and labeling 3)	12
2.	Minor dissection (dissection 4 + display 2 + drawing and labeling 2)	8
3.	Temporary mounting (staining, mounting, drawing and labeling)	8
4.	Spotting of museum specimens	
	a. Vertebrate specimens from different classes	6 items × 2.5 = 15 marks.
	b. Permanent slides	2 items × 2.5 = 5 marks.
	c. Bones	2 items × 2.5 = 5 marks.
		10 items × 2.5
		25
5.	Freshwater studies (4 species of micro fauna to be shown – identification and classification 2, characteristics 1) – 4 items × 3 =	12
6.	Report writing on field studies	15
7.	Practical Class Note Books =	10
8.	Viva-voce	10
	Total	100

#### Books Recommended

1. S.M. Manton and M.E. Brown 1969. *A Manual of Practical Vertebrate Morphology*. Oxford University Press, Oxford.
2. S. Eddy 1949. *Atlas of Drawings for Chordate Anatomy*. John Willy & Sons Inc., New York.
3. W.F. Walker 1980. *Vertebrate Dissection*. W.B. Saunders Co., London.

<b>Paper Code</b>	223007	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60 hrs.</b>
<b>Paper Title</b>	<b>Botany–II</b>			

#### 1. Cytology:

- (a) Ultra-structure of a eukaryotic cell, differences between prokaryotic and eukaryotic cell, physical and chemical composition of cell wall and plasma membrane.
- (b) Chromosome: Physical and chemical nature.
- (c) Cell division: Mitosis and meiosis and its significance.

#### 2. Genetics:

- (a) Mendel's Laws of inheritance.
  - (b) Linkage and crossing over and their impact on inheritance.
  - (c) Mutation: Definition, point mutation, physical and chemical mutagens and significance of mutation.
3. Plant Breeding and Evolution: Definition and significance of plant breeding. Method of artificial pollination in plants. Selection method. Theories of evolution: Darwin's theory and synthetic theory of evolution.

#### 4. Biotechnology:

- (a) Definition and scope.
- (b) Milk products: Technique of production of curd and butter.
- (c) Biogas technology: Production method and uses.

#### 5. Plant Ecology and Environmental Science:

- (a) Definition, differences between autecology and synecology.
  - (b) Ecological factors: Climatic, edaphic and biotic.
  - (c) Ecological adaptation and characteristics of hydrophytes, xerophytes and halophytes.
  - (d) Ecosystem: Definition; Pond ecosystem; Food chain; Food web, Ecological pyramids.
  - (e) Nitrogen and carbon cycles.
  - (f) Pollution: Air and water pollution.
  - (g) Green house effects: Definition, sources of green house gases; causes and effects of green house gases; CO<sub>2</sub>, CFC, CH<sub>4</sub> and N<sub>2</sub>O, ozone layer depletion, carbon dioxide and the world climate, control of green house effects.
6. **Conservation:** Importance of conservation of plant species. Methods of *ex-situ* and *in-situ* conservation.

#### 7. Plant Physiology and Phytochemistry:

- (a) Water relation: Mechanisms of absorption of water and minerals.
- (b) Mineral nutrition
- (c) Photosynthesis: General account and modern concept.
- (d) Respiration: Aerobic and anaerobic.
- (e) Enzymes: Definition and properties.
- (f) Photoperiodism.
- (g) Vernalization: Definition and mechanism.
- (h) Plant hormones: A general account.
- (i) Carbohydrate: Classification with examples, structures of important monosaccharides and oligosaccharides and isomerism. Storage polysaccharides; Starch, inulin, glycogen, structural polysaccharides; cellulose and economic importance of carbohydrate.

#### Books Recommended

1. Agrios, G.N. 1997: Plant Pathology (4th Ed.). Academic Press, London.
2. Benjamin Lewin. 2000: Gene 2000. Oxford University Press and Cell Press.
3. Bold, H.C. and M.J. Wynne. 1978 : Introduction to the Algae, Prentice Hall, India
4. Devlin, M.R. and H.F. Witham. 1986: Plant Physiology (4th Ed.). CBS Publishers and Distributors, New Delhi.
5. Esau, K. 1953: Plant Anatomy. John Wiley & Sons, Inc., New York.
6. Goodwin, T.W. and E.I. Mereeer. 1983: Introduction to Plant Biochemistry (2nd Ed.). Pergamon Press.
7. Hawker, Lilian, E. 1967: Fungi, Hutchinson Univ. Library, Cambridge Univ. Press, London.
8. Kumar, H.D. 1995: General Ecology, Vikash Pub. House, India.
9. Lawrence, G.H.M. 1951: Taxonomy of Vascular Plants. The Macmillan Co. New York.

10. Pelczar, M.J., E.C.S. Chan and N.R. Krieg. 1993: Microbiology: Concepts and Applications. McGraw Hill Book Co. Inc. New York.
11. Vashista, P.C. 1993: Botany for Degree Students: Pteridophyta. S.C. Chand & Co. Ltd. Ramnagar, New Delhi.
১২. আখতার জ্জামান, ম. : বংশগতি বিদ্যা, হাসান বুক হাউজ, ঢাকা।
১৩. আখতার জ্জামান, ম. ২০০০ : বিবর্তন বাদ, হাসান বুক হাউজ, ঢাকা।
১৪. ইসলাম, এ.এস. ১৯৮৪ : বংশগতি বিদ্যার মূল কথা, বাংলা একাডেমী, ঢাকা।
১৫. কর্মকার, যদুলাল. ২০০০ : উদ্ভিদ শরীর বিজ্ঞান, হাসান বুক হাউজ, ঢাকা।
১৬. খান, আমজাদ আলী এবং তরিকুল ইসলাম দ্বিতীয় উদ্ভিদ বিজ্ঞান ১ম, ২য় ও ৩য় খণ্ড।
১৭. খন্দকার মনির জ্জামান, ১৯৯৪ : লিমনোলজী, ঢাকা বিশ্ববিদ্যালয় প্রকাশনা, ঢাকা।
১৮. জামান, এম. এ. ১৯৭৫ : কোষবিদ্যা, বাংলা একাডেমী, ঢাকা।
১৯. বাসার, এম. এ., এম.এ. হাসান এবং ম. রফিকুল ইসলাম. ২০০৪ : উদ্ভিদ বিজ্ঞান, হাসান বুক হাউজ, বাংলা বাজার, ঢাকা।
২০. হাসান, এম. এ. ১৯৯৬ : বাংলাদেশের ভেষজ উদ্ভিদ, আশরাফিয়া বই ঘর, বাংলা বাজার, ঢাকা।
২১. হাসান, এম. এ. এবং এম. কে. আলম. ১৯৯৭ : উদ্ভিদ শ্রেণী বিন্যাস তত্ত্ব (৩য় সংস্করণ), হাসান বুক হাউস, ঢাকা।

<b>Paper Code</b>	223008	<b>Marks: 50</b>	<b>Credits: 2</b>	<b>Class Hours: 30 hrs.</b>
<b>Paper Title</b>	<b>Botany Practical -II</b>			

1. **Detail study including dissection (where necessary), mounting, drawing, description and identification with classification of the following genera: (any one)** **10×1=10**

Algae: *Chlamydomonas*, *Oedogonium* and *Vaucheria*.

Fungi: *Ascobolus*

Bryophyte: *Marchantia*

Pteridophyte: *Selaginella*

Gymnosperms: *Pinus*

Angiosperm: *Fabaceae*

2. **Identification of the following genera with reasons:** **6×1=6**

Algae: *Fucus*

Fungi: *Puccinia* and *Penicillium*

Lichen: *Fructose*

Bryophyte: *Semibarbula*

Pteridophyte: *Psilotum*, *Azolla* and *Pteris*

Gymnosperms: Female cones of *Cycas*

Angiosperms: Scientific names of common plants

3. **Plant Physiology: Setting up of the following experiments including procedure and precaution: (any one)** **10**

(a) Demonstration of plasmolysis

(b) Demonstration of osmosis

(c) Evolution of O<sub>2</sub> during photosynthesis.

4. **Cytology:** Different stages of mitosis in root tip of onion **04**

5. **Ecology:** **10**

(a) Morphological and anatomical studies of hydrophytic and xerophytic plants.

- (b) Ecological identification of plants with their scientific names.
6. Laboratory note book 05
7. Viva-Voce 05

### Books Recommended

1. Agrios, G.N. 1997: Plant Pathology (4th ed.). Academic Press, London.
2. Benjamin Lewin. 2000: Gene 2000. Oxford University Press and Cell Press. Bold, H.C. and
3. M.J. Wynne. 1978 : Introduction to the Algae, Prentice Hall, India
4. Devlin, M.R. and H.F. Witham. 1986: Plant Physiology (4th Ed.). CBS Publishers and Distributors, New Delhi.
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6. Goodwin, T.W. and E.I. Mereer. 1983: Introduction to Plant Biochemistry (2nd Ed.). Pergamon Press.
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9. Lawrence, G.H.M. 1951: Taxonomy of Vascular Plants. The Macmillan Co. New York.
10. Pelczer, M.J., E.C.S. Chan and N.R. Krieg. 1993: Microbiology: Concepts and Applications. McGraw Hill Book Co. Inc. New York.
11. Vashista, P.C. 1993: Botany for Degree Students: Pteridophyta. S.C. Chand & Co. Ltd. Ramnagar, New Delhi.
12. আখতার জামান, ম. : বংশগতি বিদ্যা, হাসান বুক হাউজ, ঢাকা।
13. আখতার জামান, ম. ২০০০ : বিবর্তন বাদ, হাসান বুক হাউজ, ঢাকা।
14. ইসলাম, এ.এস. ১৯৮৪ : বংশগতি বিদ্যার মূল কথা, বাংলা একাডেমী, ঢাকা।
15. কর্মকার, যদুলাল. ২০০০ : উদ্ভিদ শরীর বিজ্ঞান, হাসান বুক হাউজ, ঢাকা।
16. খান, আমজাদ আলী এবং তরিকুল ইসলাম দ্বারা উদ্ভিদ বিজ্ঞান ১ম, ২য় ও ৩য় খন্ড।
17. খন্দকার মনির জামান, ১৯৯৪ : লিমনোলজী, ঢাকা বিশ্ববিদ্যালয় প্রকাশনা, ঢাকা।
18. জামান, এম. এ. ১৯৭৫ : কোষবিদ্যা, বাংলা একাডেমী, ঢাকা।
19. বাসার, এম. এ., এম.এ. হাসান এবং ম. রফিকুল ইসলাম. ২০০৪ : উদ্ভিদ বিজ্ঞান, হাসান বুক হাউজ, বাংলা বাজার, ঢাকা।
20. হাসান, এম. এ. ১৯৯৬ : বাংলাদেশের ভেষজ উদ্ভিদ, আশরাফিয়া বই ঘর, বাংলা বাজার, ঢাকা।
21. হাসান, এম. এ. এবং এম. কে. আলম. ১৯৯৭ : উদ্ভিদ শ্রেণী বিন্যাস তত্ত্ব (৩য় সংস্করণ), হাসান বুক হাউজ, ঢাকা।

<b>Paper Code</b>	222807	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60 hrs.</b>
<b>Paper Title</b>	<b>General Chemistry–II</b>			

8. **Nonmetals:** General properties of nonmetals, ortho and para hydrogen molecules, allotropy of carbon, catenation, halogens and their basic properties, chemistry of noble gases.

9. **Metals:** Metallic bond, electron sea theory of metallic bond, characteristics of metals, band theory of conductivity, conductors, semiconductors and insulators, transition metals and inner transition metals colour and magnetism in transition metal chemistry.
10. **Energy changes in chemical Reactions:** System and surroundings, open system and closed system, thermodynamics, state functions, the first law of thermodynamics, the concept of internal energy and enthalpy, measurement of enthalpy changes, enthalpy of formation, Hess's law, lattice enthalpy, Born-Haber cycle, second law of thermodynamics, entropy and free energy.
11. **Rates of chemical Reactions:** Reaction rate, rate constant, rate law, order of reactions, first order reaction, half life, order and molecularity, effect of temperature on the rate of reaction, collision theory and reaction rates, activation energy, Arrhenius equation.
12. **Electrochemistry:** Redox reactions, electrolytic and galvanic cells, cell notation, standard reduction potentials, emf of cells, the effect of concentration of cell emf, batteries, corrosion.
13. **Catalysis:** Catalyst, homogeneous catalysis, enzyme catalysis, auto catalysis.
14. **Solids:** Properties of solids, crystalline and amorphous solids, distinction between crystalline and amorphous solids, isomorphism, polymorphism and allotropy, crystal lattice unit cell crystal systems Bragg's law.
15. **Coordination Chemistry:** Coordination compounds, ligands, coordination number, nomenclature, structures of complex compounds, Werner's primary and secondary valency concept, sidwick's electronic concept, valence bond theory, stability of coordination compounds.
16. **Aromatic Compounds:** Aromaticity aromaticity of benzene, Electrophilic aromatic substitution reactions with reference to nitration halogenation, sulphonation and alkylation. Heterocyclic compounds: Pyrrole, furan, thiophene, pyridine.
17. **Organic reactions:** Brief study on Electrophilic addition, Nucleophilic addition, Elimination reaction, condensation reaction, oxidation, and reduction reactions and organic compounds. Mechanism and application of the following reactions, Friedel Craft reaction, Clemmenson reduction, Wolf Krishner reduction, Perkin reaction, Claisen reaction, Cannizzaro reaction and Aldol condensation.
18. **Carbohydrates:** Definition, classification, structure and reactions of monosaccharides. Polysaccharide-cellulose and starch.
19. **Amino Acids:** Structures classification, synthesis physical and chemical properties of amino acids.
20. **Polymer Chemistry:** Polymers homopolymer, heteropolymer, low density and high density polymer, copolymers, studies of some polymers- polyvinylchloride, nylon 66, silk and wool.

#### **Books Recommended:**

1. General Chemistry, D.D. Ebbing Houghton Mifflin Co.
2. Chemistry – The Molecular Nature of Matter and Change, M. Silberberg, WCB/ Mc Graw-Hill.
3. Introduction to Modern Inorganic Chemistry, S.Z. Haider, Friends International.
4. Selected Topics on Advanced Inorganic Chemistry, S. Z. Haider, Students' publication

5. Modern Inorganic Chemistry, R.D. Madan, S. Chand & company Ltd.
- b. Selected Topics in Inorganic Chemistry, W.U. Malik, G. D. Tuli and R.D. Madan, S. Chand & Company Ltd.
6. Organic Chemistry by T Morison and RN bayed
7. Fundamental of organic Chemistry by Salomans
8. Organic Chemistry Vot I& II IL fair
9. Basic Inorganic Chemistry, F.A. Cotton. Wilkinson, and P. L. Gaus, John Wiley & Sons.
10. Principles of physical chemistry, M. M. Huque and M. A. Nawabs, students' publications.

<b>Paper Code</b>	222809	<b>Marks: 50</b>	<b>Credits: 2</b>	<b>Class Hours: 30 hrs.</b>
<b>Paper Title:</b>	<b>Environmental Chemistry</b>			

1. **Environment:** Introduction, components of environment, factors affecting environment, environmental management, environment and health, environmental chemistry, segments of environment – atmosphere hydrosphere, lithosphere and biosphere, structure of atmosphere.
2. **Pollution and Pollutants:** Pollution, environmental pollution, pollutant, classification of pollutants, types of pollution PCBS and their sources and hazards, Detection & estimation of PCBS. Bio-multiplication.
3. **Air Pollution:** Introduction air quality, major sources of air pollution, gaseous pollutants, acid rain, how acid rain is formed, adverse effects of acid rain, greenhouse effect, how the greenhouse effect is produced, consequences of greenhouse effect and global warming, EL-Nino phenomenon and its effect, ozone depletion, mechanism of ozone depletion, effects of ozone depletion.
4. **Water Pollution:** Introduction, classification of water pollutants, physical, chemical and biological characteristics of wastewater, industrial wastewater treatment, municipal water treatment, water quality parameters and standards, measurements of important parameters such as PH, DO, BOD, COD and temperature for water quality assessments.
5. **Soil Pollution:** Composition of soil, importance of soil to the biosphere, sources of soil pollution, effects of soil pollution- synthetic fertilizer and pesticides, effects of industrial effluents, effects of urban wastes, control of soil pollution.
6. **Heavy metals in the Environment:** trace metals, light metals and heavy metals, deadly heavy metals, sources of heavy metals, biochemical effects, toxicity, toxicology, control and treatment of mercury, chromium, arsenic and lead.

#### **Books Recommended:**

1. Environmental Chemistry, B.K. Sharma, Goel Publishing House.
2. Environmental Chemistry, AK. Dev, New Age International Publishers.
3. Environmental Chemistry, S.E. Manahan, CRC Press.
4. A Textbook of Environmental Chemistry and Pollution Control, S.S. Bara S. Chand

& Company Ltd.

<b>Paper Code</b>	222909	<b>Marks:100</b>	<b>Credits: 04</b>	<b>Class Hours: 60 hrs.</b>
<b>Paper Title</b>	<b>Biochemistry- II</b>			

- 1. Carbohydrate metabolism:** glycolysis-aerobic and anaerobic; its regulation, pentose phosphate pathway, glucuronic acid pathway; oxidation reduction reactions & redox potential, electron transport chain & oxidative phosphorylation; inhibition & uncoupling of oxidative phosphorylation. Citric acid cycle and its regulation, gluconeogenesis and its regulation. Biosynthesis of disaccharides; glycogenolysis and glycogen synthesis and their regulation.
- 2. Lipid metabolism:**  $\beta$ -oxidation and the related energetics: basic composition of lipoproteins; Synthesis of fatty acids and its regulation, Ketone bodies and their formation. Biosynthesis of Phospholipids and cholesterol. Regulation of cholesterol biosynthesis.
- 3. Amino acid metabolism:** Different methods for the degradation of amino acids; transamination, deamination, decarboxylation; biosynthesis of single carbon unit; synthesis of biologically active molecules from amino acids; urea cycle.
- 4. Central dogma:** DNA as genetic material; structure and properties of DNA replication of DNA: Transcription and different types of RNAs; structure of mRNA and tRNA, protein synthesis and inhibitors of protein synthesis.
- 5. Nutrition:** Basic concept; protein, fat & carbohydrates as nutrients: concept on micronutrients like calcium, iodine, zinc magnesium, iron.

**Books Recommended:**

- Lehninger Principle of Biochemistry*  
By: David L., Nelson and Michael M. Cox  
Publisher: W.H. Freeman and Company, New York
- Biochemistry*  
By: Lubert Stryer  
Publisher: W.H. Freeman and Company, New York
- Biochemistry*  
By: Donald Voit and Juldith Voit  
Publisher: John Willy & Sons.
- Cell and Molecular Biology*  
By: Gerald Karp  
Publisher: John Willy & Sons.

<b>Paper Code</b>	222910	<b>Marks: 50</b>	<b>Credits: 02</b>	<b>Class Hours: 30 hrs.</b>
<b>Paper Title</b>	<b>Biochemistry Practical-II</b>			

1. Determination of saponification number of oil
2. Determination of iodine number of oil
3. Estimation of total protein content by Biuret method
4. Determination of serum glucose content by Nelson-Somogy method
5. Determination of cholesterol by FeCl<sub>3</sub>- acetic acid method.
6. Determination of creatinine content of urine by the alkaline picrate method

Books Recommended:

1. *Practical Clinical Biochemistry*  
By: H. Varley  
Publisher: Arnold Hememann
2. *An Introduction to Practical Biochemistry*

<b>Paper Code</b>	221109	<b>Marks: 100</b>	<b>Non-Credit</b>	<b>Class Hours: 60 hrs.</b>
<b>Paper Title:</b>	English (Compulsory)			

**Aims and objectives of this Paper:**

To develop students' English language skills, to enable them to benefit personally and professionally. The four skills — listening, speaking, reading and writing will be integrated to encourage better language use.

**1. Reading and understanding**

5×4=20

Students will be expected to read passages that they might come across in their everyday life, such as newspapers, magazines, general books etc. Simple stories will also be included to give students a familiarity with different uses of the language.

*[N.B.: 5 Questions are to be answered. Each question will carry 4 marks. There may be division in each question]*

- a) Understanding different purposes and types of readings
- b) Guessing word-meaning in context.
- c) Understanding long sentences
- d) Recognizing main ideas and supporting ideas.
- e) Answering comprehension questions.
- f) Writing summaries.

**2. Writing**

40

- a) Writing correct sentences, completing sentences and combining sentences.

5

- b) Situational writing: Posters, notices, slogans, memos, advertisements etc.

4

- c) Paragraph writing : Structure of a paragraph; topic sentences; developing ideas; writing a conclusion; types of paragraphs (narrative, descriptive, expository, persuasive); techniques of paragraph development (such as listing, cause and effect, comparison and contrast). 8

**Or,**

- d) Newspaper writing: Reports, press releases dialogues etc.  
e) Writing resume. **Or,** 8  
f) Writing letters: Formal and informal letters, letters to the editor, request letters, job applications, complaint letters etc.  
g) Essay: Generating ideas; outlining; writing a thesis sentence; writing the essay: writing introductions, developing ideas, writing conclusions; revising and editing. 15

3. **Grammar** 25

- a) Word order of sentences.  
b) Framing questions.  
c) Tenses, articles, subject-verb agreement, noun-pronoun agreement, verbs, phrasal verbs, conditionals, prepositions and prepositional phrases, infinitives, participles, gerunds. (Knowledge of grammar will be tested through contextualized passages).  
d) Punctuation.

4. **Developing vocabulary:** Using the dictionary, suffixes, prefixes, synonyms, antonyms, changing word forms (from verb to noun etc.) and using them in sentences. 10

5. **Translation from Bengali to English.** 1×5=5

6. **Speaking skills:** Speaking skills should be integrated with writing and reading in classroom activities.

The English sound system; pronunciation skills; the IPA system; problem sounds, vowels, consonants and diphthongs; lexical and syntactic stress.

(Writing dialogue and practicing it orally students can develop their speaking skill. Dialogue writing can be an item in writing test.)