

**GENERIC ELECTIVE  
(GE-1: MOLECULES OF LIFE)**

**Credit distribution, Eligibility and Pre-requisites of the Course**

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
Molecules of Life GE 1	4	2	0	2	Class XII Science	NIL

**Learning Objectives**

The objective of the course is to provide students with an understanding of biomolecules, the basic building blocks that are vital for various life forms. The course emphasizes on studying the importance of water as a biological solvent, different types of molecules of life, focusing on their key properties, biological roles and functions. The course also aims to outline chemical and physical aspects of biomolecules by hands on approach through laboratory experiments.

**Learning outcomes**

- The course will provide an understanding of how the structures of biomolecules determine their chemical properties and functions.
- Students will develop understanding of biochemistry at atomic level and appreciate the biological importance of molecules of life.
- Students will gain insight into basic structures, classification, and biological importance of amino acids, carbohydrates, lipids and nucleic acid.

**SYLLABUS OF GE - 1**

**THEORY**

**Unit – 1**

**(2 Hours)**

**Water and Concept of Buffer:** Chemistry of water and biological importance of water, Henderson-Hasselbalch equation, concept of buffer and buffering capacity.

**Unit – 2**

**(6 Hours)**

**Structure and functions of Amino Acids:** Introduction and classification of amino acids, peptide bond, zwitterions, L and D form of amino acids, standard and non-standard amino acids and their biological importance.

**Unit – 3 (7 Hours)**

**Biochemistry of Carbohydrates:** Introduction, and classification of carbohydrates. Monosaccharides, disaccharides, polysaccharides (glycogen, starch, cellulose and chitin). D-and L- isomerism, epimers, and anomers. Carbohydrates as fuel and structural molecules, antigens and cell recognition unit.

**Unit – 4 (7 Hours)**

**Lipids in Biological system:** Introduction and classification of lipids. Fatty acids (PUFA, MUFA) triacylglycerol, phospholipids, sphingolipids, glycolipids, and cholesterol. Role of lipids as storage fuel, hormones, vitamins, in signaling and in membranes.

**Unit – 5 (8 Hours)**

**Structure and Organization of Nucleic acids:** Introduction, purine and pyrimidine bases, nucleosides, nucleotides, and nucleic acid. Structure and functions of DNA (B form), organization of DNA into chromatin; RNA structure and functions. Biologically important nucleotides (cAMP and ATP).

**PRACTICAL (60 Hours)**

- 1) Laboratory safety and preparation of solutions (molar, normal and %).
- 2) Concept of pH and working of pH meter
- 3) Preparation of acetate buffer and phosphate buffer.
- 4) Properties and analysis of amino acids (Ninhydrin, and Xanthoproteic)
- 5) Test for carbohydrates (Molisch, Fehling/ Benedict, Seliwanoff's)
- 6) Qualitative analysis of nucleic acids (Orcinol and Diphenyl amine)

**ESSENTIAL/ RECOMMENDED READINGS**

- 1) Nelson, D.L. and Cox, M.M. (2017). Lehninger: Principles of Biochemistry (7th ed.). W.H. Freeman & Company (New York), ISBN:13: 9781464126116 / ISBN:10-1464126119.
- 2) Plummer D.T. (1998). An Introduction to Practical Biochemistry (3rd ed)., Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4 / ISBN:10: 0-07-099487-0.
- 3) Pratt, C.W. and Cornely, K. (2017). Essential Biochemistry (4th ed.) John Wiley& Sons, Inc.ISBN:9781119012375

**SUGGESTIVE READING:**

- 1) Berg, J.M., Tymoczko J.L. and Stryer L. (2011). 7th Edition. Biochemistry. New York, USA: W. H. Freeman and Co. ISBN-13: 978142927635.
- 2) Campbell, M.K. and Farrel, S.O. (2017). 9<sup>th</sup> Edition. Biochemistry. Boston, USA: Brooks/Cole Cengage Learning. ISBN-13: 978-1305961135.

**Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.**

**GENERIC ELECTIVES (GE-2): TECHNIQUES IN BIOCHEMISTRY****Credit distribution, Eligibility and Pre-requisites of the Course**

Course title & Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
	Lecture	Tutorial	Practical/ Practice		
Techniques in Biochemistry	4	2	0	2	Class XII Science

GE 2

**Learning Objectives**

The objective of the course is to introduce different biophysical techniques to students that are used in biological research for separation, purification and identification from mixture of biomolecules. The emphasis is also on experimental skills in the form of practical exercises so that students can apply this knowledge to improve their understanding of the subject for better utilization of these techniques in research and will also help in their placement.

**Learning outcomes**

- Students will acquire knowledge about the principles and applications of separation and purification techniques like centrifugation and chromatography used in a biochemistry laboratory.
- Students will learn about the principles and applications of electrophoresis and spectroscopic techniques involved in estimation and identification of biomolecules.

- It will also give them an opportunity to get hands-on experience to develop their experimental skills which are required for biological research lab.

## **SYLLABUS OF GE – 2**

### **Unit - 1 (8 Hours)**

**Separation techniques:** Preparation of sample, different methods of cell lysis, salting out, dialysis. Principle and the factors affecting centrifugation Svedberg coefficient, types of rotors, principle and applications of differential and density gradient centrifugation.

### **Unit – 2 (8 Hours)**

**Purification techniques:** Classification of chromatographic techniques, principle and applications: Paper, thin layer, molecular sieve, ion exchange, and affinity chromatography.

### **Unit - 3 (7 Hours)**

**Electrophoretic techniques:** Principle of electrophoresis, various types of electrophoresis: Polyacrylamide gel (native), SDS PAGE and agarose gel, staining procedures for protein and nucleic acids.

### **Unit - 4 (7 Hours)**

**Spectroscopic techniques:** Introduction to electromagnetic spectrum, Principle and working of UV-visible absorption spectrophotometer, single & double beam spectrophotometer, Beer's & Lambert's law, application of UV-visible spectrophotometer in biology.

### **Practical**

**(60 Hours)**

- 1) Preparation of cell free extract from E.coli culture.
- 2) Separation and identification of amino acid acids by thin layer chromatography.
- 3) Separation of molecules by gel filtration chromatography.
- 4) Determination of absorption maxima ( $\lambda_{max}$ ).
- 5) Calculate molar extinction coefficient of the given sample.
- 6) Demonstration of PAGE and Agarose gel electrophoresis.

### **ESSENTIAL/RECOMMENDED READINGS**

- 1) Wilson, K. & Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology, (7th ed.), Cambridge University Press; ISBN 978-0-521-51635-8.
- 2) Boyer, R. F. (2012). Biochemistry Laboratory: Modern Theory and Techniques, (6th ed.), Boston, Mass: Prentice Hall; ISBN-13: 978-0136043027.

- 3) Plummer, D. T. (1998). An Introduction to Practical Biochemistry (3rd ed.), Tata McGraw Hill Education Pvt. Ltd. (New Delhi); ISBN: 13: 978-0-07-099487-4 / ISBN:10: 0-07-099487-0.

**SUGGESTIVE READING:**

- 1) Cooper, T.G. (2011). The Tools of Biochemistry (2nd ed.), Wiley-Interscience Publication (New Delhi); ISBN: 13:9788126530168.
- 2) Freifelder, D. (1982). Physical Biochemistry: Applications to Biochemistry and Molecular Biology, (2nd ed.), W.H. Freeman and Company (New York); ISBN:0-7167- 1315-2 / ISBN:0-7167-1444-2.

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**GENERIC ELECTIVES (GE-3): PUBLIC HEALTH BIOLOGY**

**Credit distribution, Eligibility and Pre-requisites of the Course**

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
Public Health Biology	4	2	0	2	Open to All	NIL

GE 3

**Learning Objectives**

The present course attempts to provide an interdisciplinary understanding of public health issues in India with a more detailed understanding of the areas pertaining to biological science and epidemiology. Some overview of the social aspects that impact public health will also be discussed and the statistical analysis of public health data will be taught in the practical. The specific objectives of the course are to provide a basic understanding of the scope of public health issues, particularly related to policies on public health, public health nutrition, infectious biology and sanitation, social and preventive medicine, and the environmental issues that affect public health. The practical exercises aim to provide hands-on training in epidemiology and collection of primary and secondary data relevant to public health issues. It also hopes to

generate a discussion platform that would encourage a healthy inter- and multidisciplinary interaction amongst the students to get a holistic view of public health. A mini research project on any relevant topic related to public health will be taken up after completing the theory and practical components of the course. Being interdisciplinary in its nature and scope, the course will be equally engaging and beneficial for students of all subject streams. After completing the course, the students can also apply for some higher-level courses in different areas of public health as the course helps in building a basic understanding on different aspects related to public health.

### **Learning outcomes**

On successful completion of the course

- Students will get a holistic overview of the interdisciplinary nature of Public Health
- They will understand public health issues in India particularly related to Malnutrition, sanitation issues and related burden of infectious disease, and the role of pollution as a public health concern.
- The students will also get an understanding of the public policies applicable and implemented in India.
- They will also be able to appreciate the social aspects that govern many public health issues and implementation of policies
- The students will get hands-on training in epidemiology, preparation of questionnaire and collection of primary and secondary data relevant to public health issues.
- They will also learn to present the relevant data after subjecting it to statistical analysis.

## **SYLLABUS OF GE – 3**

### **THEORY**

#### **Unit – 1 (04 Hours)**

**Understanding public health issues:** Conceptual understanding of public health, terminology, public health- multidimensional problem with Delhi as an example (air pollution, stress, sanitation, urbanization and socioeconomic inequalities) Policies on public health- factors affecting making and implementation of these policies.

#### **Unit – 2 (10 Hours)**

**Public Health Nutrition:** Characteristics of tertiary and quaternary structures. Structure function relationship in proteins. 3D structures of globular and fibrous proteins – myoglobin, hemoglobin, collagen and keratin. Protein folding - denaturation and renaturation (Ribonuclease A). Role of chaperones. Protein misfolding diseases - Alzheimer's and Cruetzfeldt-Jakob disease.

#### **Unit – 3 (06 Hours)**

**Infectious biology and sanitation:** Defining communicable diseases. Understanding the biology, socioeconomic factors and other environmental conditions that influence the transmission and infection by pathogenic (disease-causing) bacteria, viruses, parasites, and fungi. Precautions, prevention strategies and programs for control; sanitation, Swachh Bharat.

#### **Unit – 4**

**(10 Hours)**

**Environmental Health & Community Health:** Determinants of Environmental Health: factors that affect environmental health; Occupational environment and health concerns; Understanding effect of air, water and soil Pollution on health.

Understanding the definition of community health, Determinants of community health; Define and manage the health problems of the community, Plan, implement and evaluate various health programs of General Health, Reproductive health, Maternal health, Family Welfare and Disease control / eradication.

Lifestyle disease or non-communicable diseases- consequence of imbalanced nutrition, environmental and psychological stresses; Etiology and management of diseases like Obesity, Diabetes mellitus, Cardiovascular disorders, sleep disorders and psychological eating disorders. Preventive health checkups (PHC)- important parameters/biomarkers; relevance of PHC in health and disease prevention/early diagnosis

#### **PRACTICAL**

**(60 Hours)**

- 1) Assessment of nutritional status using anthropometric indices
- 2) Assessment of Nutritional status by a survey of clinical and non-invasive biochemical parameters.
- 3) To determine the potability of water using, pH, BOD, COD and MPN of the water sample from different sources.
- 4) Collecting secondary data on AQI from different areas and correlate with health indices in that area.
- 5) Understanding epidemiology: Collection, generation, and analysis of public health data. Application of statistical tools to analyze and present public health data.
- 6) Case study of a disease (Nutritional, infectious and lifestyle) along with the public health issues associated with that disease.
- 7) Field visits to nearby health care center to understand health checkups and collect some data on the rate of a particular disease over past few months or years.
- 8) Data collection from public domain with analysis.

## **ESSENTIAL/ RECOMMENDED READINGS**

- 1) Aschengrau A, Seage G.R., (2013) Essentials of Epidemiology in Public Health Jones and Bartlett Publishers, Inc; 3rd edition
- 2) Bamji MS, Rao NP, Reddy V. (2017). Textbook of Human Nutrition. (4th ed). Delhi: Oxford and IBH Publishing Co. (P) Ltd.
- 3) Soil Microbiology by N.S. Subba Rao. 5th edition. Medtech, India. 2017.
- 4) Environmental Microbiology edited by I.L. Pepper, C.P. Gerba, T.J. Gentry. 3rd edition. Academic Press, USA. 2014.

## **SUGGESTIVE READING:**

- 1) Sullivan. L.M. (2017) Essentials of Biostatistics in Public Health. Jones and Bartlett Publishers, Inc; 3rd edition.
- 2) Gibney et al. (2004). Public health nutrition. Hoboken, NJ: Blackwell Publishing
- 3) N. Okafor. (2011) Environmental Microbiology of Aquatic and Waste Systems by Springer, USA.
- 4) Waste Water Microbiology by D.H. Bergey. 2nd Edition. Medtech, India. 2019.

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