

## Course Outcomes – Program Outcomes (COPO) Mapping

### For BSc Life Science (NEP)

Life Science has three components:

- I. BSc LIFE SCIENCE BOTANY COMPONENT
- II. BSc LIFE SCIENCE ZOOLOGY COMPONENT
- III. BSc LIFE SCIENCE CHEMISTRY COMPONENT

### Undergraduate Curriculum Framework (UGCF)

#### National Education Policy (NEP)

The Preamble of the Undergraduate Curriculum Framework-2022 underlines the historical perspective, philosophical basis, and contemporary realities of higher education as enshrined in the National Education Policy 2020 and endeavours to synchronize these cornerstones while charting the road ahead for the state of higher education.

#### ABBREVIATIONS / NOMENCLATURE

Sno.	Nomenclature	Description	Aggregate Courses
1.	PO	Program Outcome	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8
2.	CO	Course Outcome	CO1, CO2, CO3, CO4, CO5, CO6, CO7
3.	DSC	Core Courses	DSC1, DSC2, DSC3, DSC4.
4.	DSE	Discipline Specific Electives	DSE1, DSE2

## I. BSc LIFE SCIENCE BOTANY COMPONENT

### PROGRAM OUTCOMES (PO): BSc LIFE SCIENCE BOTANY COMPONENT

#### UGCF (NEP)

<b>Program Outcomes (PO): B.Sc. Life Sciences (Botany )</b>	<b>Statements</b>
<b>PO1</b>	Students of the B.Sc. Life Sciences programme will learn to use scientific logic as they explore a wide range of contemporary subjects spanning various basic and applied aspects life sciences
<b>PO2</b>	Students will appreciate the biological diversity of plant and animals and compounds in them to be able to describe/explain the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations. They will become aware of the important role of plant and animals in ecosystem functioning
<b>PO3</b>	Students will gain knowledge of various biotechnological applications of plants and animals and will learn of industrially important natural products produced by them.
<b>PO4</b>	Students will become familiar with scientific methodology, hypothesis generation and testing, design and execution of experiments. Students will develop the ability to think critically and to read and analyze scientific literature.
<b>PO5</b>	Students will acquire and demonstrate proficiency in good laboratory practices in biological sciences and be able to explain the theoretical basis and practical skills of the tools/technologies commonly used to study this field.
<b>PO6</b>	Students will develop proficiency in the quantitative skills necessary to analyze biological problems (e.g., arithmetic, algebra, and statistical methods as applied to biology)
<b>PO7</b>	Students will develop strong oral and written communication skills through the effective Presentation of experimental results as well as through seminars.
<b>PO8</b>	Graduates of the B.Sc. programme in Life Sciences will make the students understand and evaluate the impact of new research discoveries in the life sciences, and will be able to stimulate to think on wide range of careers, including biological and medical research in higher education institutions as well as careers in public and global

	health, scientific writing, environmental organizations, and food, pharmaceuticals and biotechnology industries.
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**Course Outcomes (CO): BSc LIFE SCIENCE BOTANY COMPONENT**

<b>SEMESTER I:</b>			
<b>DSC1: Plant Diversity &amp; Systematics</b>			
<b>Unique Paper Code</b>	<b>Name of the Paper</b>	<b>Course Outcome: CO</b>	<b>Statement</b>
2162521101	<b>DSC1: Plant and Anatomy and Embryology</b>	CO1	This course will be able to impart basic knowledge and understanding of the diversity of plants and microbes
		CO2	the possible relationships between each group
		CO3	their general characteristics
		CO4	approaches used for identification and classification of various groups of plants

**COPO MAPPING**

Papers	<b>SEMESTER I: COPO MAPPING</b>								
	Program Outcome : PO								
	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
DSC1	CO1	✓	✓						
	CO2	✓	✓						
	CO3	✓	✓						
	CO4	✓	✓						✓

**SEMESTER II:****DSC2: Genetics and Molecular Biology**

<b>Unique Paper Code</b>	<b>Name of the Paper</b>	<b>Course Outcome: CO</b>	<b>Statement</b>
2162521201	<b>DSC2: Genetics and Molecular Biology</b>	CO1	understand the fundamentals of Mendelian inheritance and non-Mendelian inheritance.
		CO2	describe the concepts of linkage and crossing over and their usage in constructing genetic maps.
		CO3	Gain knowledge about chromosomal aberrations and mutations.
		CO4	Become familiar with structure and function of nucleic acids with reference to replication, transcription and translation.
		CO5	understand the mechanisms of gene regulation

**COPO MAPPING**

Papers	<b>SEMESTER II : COPO MAPPING</b>								
	Program Outcome : PO								
	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
DSC2	CO1	✓	✓						
	CO2	✓	✓						✓
	CO3	✓	✓						✓
	CO4	✓	✓						✓
	CO5	✓	✓						✓

**SEMESTER III:**

**DSC3: Plant Cell and Developmental Biology**

<b>Unique Paper Code</b>	<b>Name of the Paper</b>	<b>Course Outcome: CO</b>	<b>Statement</b>
2162522301	DSC3: Plant Cell and Developmental Biology	CO1	On completion of the course, the students will become familiar with the structure and functions of various components of plant cell
		CO2	understand the processes of cell growth and its regulation
		CO3	comprehend the structure, organization and functions of various tissues of the plant organs and conservation of plants
		CO4	get acquainted with the reproductive processes in the life cycle of angiosperms
		CO5	appreciate the interactions between the developmental pathways resulting in the differentiation of plant body
		CO6	Recognise the importance of plant developmental biology in the improvement

**DSE1: Biostatistics & Bioinformatics for Plant Sciences**

2163012002	<b>DSE1:</b> Biostatistics & Bioinformatics for Plant Sciences	CO1	At the end of this course students will be able to:use the various online databases and resources for accessing biological data.
		CO2	Use the different methods of alignment of DNA, RNA and protein sequences and interpret the significance of the same.
		CO3	Understand the descriptive and inferential statistical tests for interpretation of experimental data

Papers	<b>SEMESTER III: COPO MAPPING</b>								
	Program Outcome: PO								
	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
DSC3	CO1	✓	✓						
	CO2	✓	✓						
	CO3	✓	✓						✓
	CO4	✓	✓						✓
	CO5	✓	✓						✓
	CO6	✓							✓
DSE1	CO1	✓			✓				✓
	CO2	✓			✓				✓
	CO3	✓			✓				✓

<b>SEMESTER IV:</b>			
<b>DSC4: Ecology and Evolution</b>			
<b>Unique Paper Code</b>	<b>Name of the Paper</b>	<b>Course Outcome: CO</b>	<b>Statement</b>
2162512401	<b>DSC4:</b> Ecology and Evolution	CO1	After successful completion of the course the student shall have adequate knowledge about the basic principles of ecology and evolution.

<b>DSE2: Industrial and Environmental Microbiology</b>			
2163012004	<b>DSE2: Industrial and Environmental Microbiology</b>	CO1	understand how microbiology is applied in manufacturing of industrial products
		CO2	know about design of bioreactors
		CO3	understand the rationale in medium formulation, design for microbial fermentation, sterilization of medium and air
		CO4	comprehend the techniques and the underlying principles in upstream and downstream processing
		CO5	learn the occurrence, abundance and distribution of microorganism in the environment and their role in the environment and also learn different methods for their detection
		CO6	understand the basic principles of environment microbiology and application of the same in solving environmental problems - waste water treatment and bioremediation
		CO7	comprehend the various methods to determine the quality of water

Papers	<b>SEMESTER IV: COPO MAPPING</b>								
	Program Outcome : PO								
	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
DSC4	CO1	✓							✓
DSE2	CO1	✓	✓						✓
	CO2		✓						✓
	CO3	✓	✓						✓

	CO4	✓							✓
	CO5	✓	✓						✓
	CO6	✓							✓
	CO7	✓	✓						✓



## II. B.Sc. LIFE SCIENCE ZOOLOGY COMPONENT

### PROGRAM OUTCOMES (PO): BSc LIFE SCIENCE ZOOLOGY COMPONENT

<b>Program Outcomes (PO): B.Sc. Life Science (Zoology)</b>	<b>Statements</b>
<b>PO1</b>	Students enrolled in B.Sc. (Program) Life Sciences will study and acquire complete knowledge of disciplinary and allied biological sciences. At the end of graduation, they would have expertise which will provide them competitive advantage in pursuing higher studies from India and abroad or seek jobs in academia, research or industries.
<b>PO2</b>	Students should be able to identify, classify and differentiate in types of chordates and nonchordates based on their morphological, anatomical and systemic organization. This will create a curiosity and awareness among them to explore the animal diversity and take up wildlife photography or wildlife exploration as a career option. The procedural knowledge about identifying and classifying animals will help students professional advantages in teaching, research and taxonomist jobs in various Government organizations, such as Zoological Survey of India or National Sanctuaries.
<b>PO3</b>	Acquired practical skills in biochemistry and biotechnology can be used in pursuing career as a scientist in pharmaceutical industry in India or abroad.
<b>PO4</b>	Students will be gaining basic experimental skills in genetics, biotechnology, qualitative and quantitative microscopy, and also enzymology that will give them an edge to pursue higher studies.
<b>PO5</b>	The skill enhancement courses will hone skills in rearing fish, bees and silk moth for generating self-employment.
<b>PO6</b>	Students can acquire expertise to join clinical and research laboratories for diagnostic assays, haematology, histopathology, staining procedures etc.
<b>PO7</b>	They will be able to examine and assess some basic physiological functions and interpret physiological charts.

**COURSE OUTCOMES (CO): B.Sc. LIFE SCIENCE ZOOLOGY COMPONENT**

**For NEP**

<b>SEMESTER 1:</b>								
<b>DSC1: Diversity of Animals</b>								
<b>Code</b>	<b>Name of the Paper</b>			<b>Course Outcome: CO</b>	<b>Statement</b>			
UPC-2232521101	<b>DSC-1: Diversity of Animals</b>			CO1	Students will acquire knowledge of diversity of non -chordates and chordates			
				CO2	The students will learn characteristics, morphotaxonomy, structural organization and physiological life system of diverse animal groups			
				CO3	They will understand the economic importance of non-chordates and chordates and their importance in the ecosystem			
				CO4	It will also help them learn evolutionary relationships and phylogeny of invertebrates and vertebrates to structural as well as functional similarities			
<b>COPO MAPPING</b>								
Papers	<b>SEMESTER I: COPO MAPPING</b>							
	Program Outcome : PO							
	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7

DSC1	CO1		✓					
	CO2							✓
	CO3		✓					
	CO4		✓					

<b>Semester -II</b> <b>DSC2: Cell and Development biology of Animals</b>			
UPC-2232521201	<b>DSC 2:Cell and Development biology of Animals</b>	CO1	Explain the structure and functions of cell organelles involved in diverse cellular processes
		CO2	Know the evolution of different concepts in development biology.
		CO3	To understand the process of gamete formation from stem cells population to mature ova .Students will know the difference between spermatogenesis and oogenesis
		CO4	It will help the students to understand how polyspermy is avoided in animal kingdom
		CO5	Learn the mechanism underpinning cellular diversity and specificity in animals
		CO6	Learn the methods and tools related to developmental biology and understand processes of embryogenesis

<b>COPO MAPPING</b>	
Papers	<b>SEMESTER I I: COPO MAPPING</b>

Program Outcome: PO								
	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
DSC2	CO1	✓						
	CO2	✓						
	CO3							
	CO4							
	CO5							
	CO6	✓						

Semester -III			
DSC3: Biochemistry: Basic concepts of Metabolism			
UPC:223252230	DSC3: Biochemistry: Basic concepts of Metabolism	CO1	The student would understand the properties of carbohydrates ,proteins, lipids and their importance in biological system.
		CO2	Explain the biological mechanisms such as processes and control of bioenergetics and metabolism as chemical processes.
		CO3	They will be able to comprehend the concept of enzyme ,it's mechanism of action and regulation.
		CO4	Appreciate the importance of high energy compounds ,electron transport chain , synthesis of ATP under aerobic and anaerobic conditions
		CO5	They will acquire knowledge related to the role of TCAcycle in central carbon metabolism , importance of anaplerotic reactions and redox balance.

COPO MAPPING								
Papers	SEMESTER III: COPO MAPPING							
	Program Outcome: PO							
	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
DSC3	CO1			✓				
	CO2			✓				
	CO3				✓			
	CO4							
	CO5			✓	✓			

Semester -IV			
DSC4: Fundamentals of Human Physiology			
UPC:2232522401	DSC 4: Fundamentals of Human Physiology	CO1	By studying this course, students will be able to have an enhanced knowledge and appreciation of human physiology
		CO2	Recognize and identify principal tissue structures and functions
		CO3	Better understand the functions of important physiological systems including the nervous system, muscular system, endocrine and reproductive system
		CO4	Learn an integrative approach to understand how these separate systems interact to yield integrated physiological responses to maintain homeostasis in the body along with feedback mechanism.

COPO MAPPING								
Papers	SEMESTER IV: COPO MAPPING							
	Program Outcome: PO							
DSC4	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
	CO1							
	CO2	✓						
	CO3						✓	✓
	CO4			✓			✓	

DSE-1: Wildlife Conservation and Management			
UPC:2233012004	DSE-1: Wildlife Conservation and Management	CO1	By studying this course, students will be able to appreciate wildlife in general and realize its conservation and management in general
		CO2	Better understand the application of the principles of ecology and animal behaviour to formulate strategies for the management of wildlife populations and their habitats
		CO3	Understand the management practices required to achieve a healthy ecosystem for wildlife population along with emphasis on conservation and restoration.
		CO4	Comprehend the key factors for loss of wildlife and important strategies for their in situ ex-situ conservation.
		CO5	Recognize the techniques for estimation remote sensing and global positioning tracking for wildlife.

		C06	Gain knowledge about wildlife diseases and the quarantine policies.
		C07	Perform critical thinking ,literature review,scientific writing as well as presentations and participation in citizen science initiatives with reference to wildlife.

Papers	<b>SEMESTER IV: COPO MAPPING for DSE 1</b>							
	Program Outcome: PO							
	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>DSE 1</b>	CO1		✓					
	CO2	✓						
	CO3		✓					
	CO4	✓						
	CO5			✓				
	CO6			✓				
	CO7			✓				

<b>DSE-2: PARASITOLOGY</b>			
UPC:2272201101	<b>DSE 2:Parasitology</b>	CO1	By studying this course, students will be able to better understand the variation amongst parasites, parasitic invasion in animals; applicable to medical and agriculture aspects
		CO2	Identify the stages of the life cycles of parasites and their respective infective stages. develop ecological model, on the base knowledge of population dynamics of parasites.
		CO3	Understand the concept of production and costs in detail
		CO4	comprehend the different methods adopted by parasites to combat with the host immune system.
		CO5	Develop skills and realize significance of diagnosis of

			parasitic attack and treatment of patient or host.
		C06	Analyse and interpret the case studies to highlight innovative researches, serendipities towards the advancement and enrichment of knowledge in the field of Parasitology.

Papers	SEMESTER IV: COPO MAPPING for DSE 2							
	Program Outcome: PO							
DSE 2	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
	CO1							
	CO2	✓					✓	
	CO3						✓	
	CO4	✓						✓
	CO5			✓				
	CO6			✓				

## I. B. Sc. LIFE SCIENCE CHEMISTRY COMPONENT

### Program Outcomes (PO): B.Sc(Prog) Life Science

#### NEP

S.No.	Program Outcomes (PO): B.Sc Life Sciences (Chemistry)	Statements
1.	PO1	Knowledge: Students acquire theoretical knowledge and understanding of the fundamental concepts, principles and processes in main branches of chemistry, namely, organic chemistry, inorganic chemistry, physical chemistry, analytical chemistry and biochemistry. In depth understanding is the outcome of transactional effectiveness and treatment of specialized course contents. Width results from the choice of electives that students are offered.
2.	PO2	Laboratory Skills: A much valued learning outcome of this programme is the laboratory skills that students



		develop during the course. Quantitative techniques gained through hands on methods opens choice of joining the industrial laboratory work force early on. The programme also provides ample training in handling basic chemical laboratory instruments and their use in analytical and biochemical determinations. Undergraduates on completion of this programme can cross branches to join analytical, pharmaceutical, material testing and biochemical labs besides standard chemical laboratories.
3.	<b>PO3</b>	Communication: Communication is a highly desirable attribute to possess. Opportunities to enhance students' ability to write methodical, logical and precise reports are inherent to the structure of the programme. Techniques that effectively communicate scientific chemical content to large audiences are acquired through oral and poster presentations and regular laboratory report writing.
4	<b>PO4</b>	Capacity Enhancement: Modern day scientific environment requires students to possess ability to think independently as well as be able to work productively in groups. This requires some degree of balancing. This life science chemistry programme course is designed to take care of this important aspect of student development through effective teaching learning process.
5	<b>PO5</b>	Portable Skills: Besides communication skills, the programme develops a range of portable or transferable skills in students that they can carry with them to their new work environment after completion of this life science programme course. These are problem solving, numeracy and mathematical skills- error analysis, units and conversions, information retrieval skills, IT skills and organizational skills. These are valued across work environments

**COURSE OUTCOMES (CO): B. Sc. LIFE SCIENCE CHEMISTRY COMPONENT**

<b>SEMESTER I:</b>			
<b>DSC1: Basic concept of organic chemistry</b>			
<b>Code</b>	<b>Name of the Paper</b>	<b>Course Outcome: CO</b>	<b>Statement</b>
		CO1	The course enables the students to understand and explain the differentials behaviour of organic

2172511101	<b>DSC1:</b> Basic concept of organic chemistry		compounds based on fundamental concepts learnt
		CO2	The students can understand the fundamental concepts of stereochemistry.
		CO3	Students can formulate the mechanisms of organic reactions by recalling and correlating the fundamental properties of the reactants involved
		CO4	Students can learn and identify many organic reactions and their mechanisms including electrophilic addition, nucleophilic addition, nucleophilic substitution, electrophilic substitution and rearrangement reactions

### COPO MAPPING

Papers	<b>SEMESTER I: COPO MAPPING</b>					
	Program Outcome : PO					
	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5
DSC1	CO1	✓	✓			
	CO2	✓	✓		✓	
	CO3		✓		✓	
	CO4	✓	✓	✓	✓	

<b>SEMESTER II</b>			
<b>DSC2: Chemical bonding and elements in biological system</b>			
Code	Name of the Paper	Course Outcome: CO	Statement
		CO1	Students can understand the concept of lattice energy using Born-Landé and Born-Haber cycle and their applications
		CO2	Students can rationalize the conductivity of metals, semiconductors and insulators based on the band theory

2172521201	<b>DSC 2:</b> Chemical bonding and elements in biological system	CO3	Students can understand the importance and applications of chemical bonds, inter-molecular and intramolecular weak chemical forces and their effect on melting points, boiling points solubility and energetics of dissolution
		CO4	Students can know about the essential and non essential, trace and toxic metal ions and their role in biological system and effects of their deficiency. They will also learn their dose response relationship curves
		CO5	Students can understand active and passive transport and diagrammatically explain the working of the sodium-potassium pump in organisms and the factors affecting it
		CO6	Students can explain the sources and consequences of excess and deficiency of trace metals and learn about the toxicity of certain metal ions, the reason for the toxicity
		CO7	Students can understand the storage and transport of iron in bio-systems

Papers	<b>SEMESTER II : COPO MAPPING</b>					
	Program Outcome : PO					
	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5
DSC2	CO1	✓				
	CO2	✓	✓		✓	
	CO3		✓		✓	
	CO4		✓	✓	✓	
	CO5		✓	✓	✓	
	CO6		✓	✓	✓	
	CO7		✓		✓	

<b>SEMESTER III:</b> <b>DSC3: Chemical energetics and equilibria</b>
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Code	Name of the Paper	Course Outcome : CO	Statement
2172512302	<b>DSC3:</b> Chemical energetics and equilibria	CO1	Students will be able to explain the laws of thermodynamics, thermochemistry and equilibria
		CO2	Students will be able to illustrate the concept of pH and its effect on the various physical and chemical properties of the compounds
		CO3	Students will be able to Explain and draw the concepts to predict feasibility of chemical reactions and to study the behaviour of reactions in equilibrium

**DSE1: Polynuclear Hydrocarbons, Pharmaceutical Compounds, UV Visible & IR Spectroscopy**

Code	Name of the Paper	Course Outcome : CO	Statement
2173522002	<b>DSE 1:</b> Polynuclear Hydrocarbons, Pharmaceutical Compounds, UV Visible & IR Spectroscopy	CO1	Students can understand the fundamentals of polynuclear hydrocarbons and heterocyclic compounds through the study of methods of preparation, properties and chemical reactions with underlying mechanism.
		CO2	Students can gain insight into the basic fundamental principles of IR and UV-Vis spectroscopic techniques.
		CO3	Students can use basic theoretical principles underlying UV-visible and IR spectroscopy as a tool for functional group identification in organic molecules.

Papers	<b>SEMESTER III : COPO MAPPING</b>					
	Program Outcome : PO					
	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5
DSC3	CO1	✓	✓		✓	

	CO2	✓	✓	✓	✓	
	CO3		✓	✓	✓	
DSE1	CO1	✓	✓	✓	✓	
	CO2	✓	✓	✓	✓	
	CO3	✓	✓	✓	✓	

**SEMESTER IV:**

**DSC4: Chemistry of carboxylic acids and their derivatives, amines and heterocycles**

<b>Code</b>	<b>Name of the Paper</b>	<b>Course Outcome : CO</b>	<b>Statement</b>
21725112401	<b>DSC 4:</b> Chemistry of carboxylic acids and their derivatives, amines and heterocycles	CO1	Students can understand reactions of carboxylic acids, esters, amides, amines and diazonium salts
		CO2	Understand the concept of protection and deprotection.
		CO3	Students can use the synthetic chemistry learnt in this course to do functional group transformations.
		CO4	Students can gain theoretical understanding of chemistry of heterocyclic compounds.

**DSE2: Analytical methods in chemistry**

<b>Code</b>	<b>Name of the Paper</b>	<b>Course Outcome : CO</b>	<b>Statement</b>
2173522008	<b>DSE2:</b> Analytical methods in chemistry	CO1	Students can understand various sources of errors in chemical analysis.
		CO2	Students can learn about methods to minimize error.
		CO3	Students can understand basic principle of instrumentation (Flame Photometer, UV-vis spectrophotometer, Atomic Absorption spectrophotometer).

		CO4	Students can apply the principles of analysis and instrumentation to analyse soil samples, soft drinks and synthetic mixtures provided in the laboratory
		CO5	Students can learn basic principles of separation techniques (chromatography and solvent extraction) and apply them to separate mixtures.
		CO6	Students can understand principles of Gravimetric analysis and apply them in determination of Ni <sup>2+</sup> and Al <sup>3+</sup>
		CO7	Students can analyse samples independently in the laboratory

Papers	SEMESTER IV : COPO MAPPING					
	Program Outcome : PO					
	Course Outcome: CO	PO1	PO2	PO3	PO4	PO5
DSC4	CO1	✓	✓		✓	
	CO2	✓		✓	✓	
	CO3		✓	✓	✓	
	CO4	✓			✓	
DSE2	CO1		✓	✓		✓
	CO2			✓	✓	
	CO3	✓	✓	✓		
	CO4	✓	✓		✓	
	CO5	✓	✓	✓	✓	
	CO6	✓	✓	✓		
	CO7		✓	✓	✓	