Criteria 2.6.1
2018-19

## Program Outcome of B.Sc.

1. **Foundational Knowledge:** Graduates should have a solid understanding of the fundamental concepts and principles in their chosen field of study, whether it's physics, chemistry, biology, computer science, mathematics, or any other science-related discipline.
2. **Analytical Skills:** B.Sc. graduates are expected to have developed strong analytical and problem-solving skills, enabling them to identify and address scientific challenges and inquiries.
3. **Laboratory and Research Skills:** Many B.Sc. programs include laboratory work and research projects to equip students with hands-on experience in conducting experiments, collecting data, and analyzing results.
4. **Scientific Communication:** Graduates should be proficient in communicating scientific ideas, both orally and in writing. This skill is crucial for presenting research findings, writing reports, and collaborating with colleagues.
5. **Critical Thinking:** B.Sc. programs aim to cultivate critical thinking abilities, allowing graduates to evaluate information objectively and make evidence-based decisions.
6. **Quantitative Skills:** Depending on the specialization, students might develop strong quantitative skills, which are essential for data analysis and modeling in various scientific disciplines.
7. **Interdisciplinary Understanding:** Some B.Sc. programs encourage an interdisciplinary approach, exposing students to multiple branches of science to foster a broader perspective on scientific issues.
8. **Ethics and Professionalism:** Graduates are expected to be aware of ethical considerations in scientific research and practice and to conduct themselves professionally in their academic and future career endeavors.

## Program Specific Outcome: Zoology

1. **Taxonomy and Diversity:** Graduates should be able to demonstrate a comprehensive understanding of the diversity of animal life, including the classification, identification, and characteristics of different animal groups.
2. **Anatomy and Physiology:** Students should have a solid knowledge of the anatomy and physiology of various animal species, including their organ systems and functions.
3. **Ecology and Behavior:** Graduates should be familiar with ecological principles and animal behavior, understanding the interactions between organisms and their environment.
4. **Evolution and Adaptations:** Students should have an understanding of evolutionary processes and how animals have adapted to different ecological niches over time.
5. **Conservation and Wildlife Management:** Graduates should be aware of the importance of wildlife conservation and the techniques used in managing and preserving animal populations and habitats.
6. **Research and Scientific Methodology:** Students should be equipped with research skills, including data collection, analysis, and interpretation relevant to zoological studies.
7. **Laboratory and Field Techniques:** Graduates should have practical experience in using laboratory and field techniques commonly employed in zoological research.
8. **Bioethics and Animal Welfare:** Students should be aware of ethical considerations in zoological research and have an understanding of animal welfare issues.

9. **Communication Skills:** Graduates should be able to effectively communicate scientific findings and ideas, both in writing and verbally.
10. **Interdisciplinary Knowledge:** Students may gain exposure to interdisciplinary aspects of zoology, such as genetics, ecology, biotechnology, and environmental science.
11. **Critical Thinking and Problem-Solving:** Graduates should be able to apply critical thinking and problem-solving skills to analyze complex biological issues related to animals.
12. **Career and Professional Development:** Students may receive guidance on career options in zoology and develop the necessary skills to pursue further education or employment in the field.

## Course Outcome:

### Life and Diversity of Animals- Non-Chordates.

1. Introduction to Non-chordate Animals: An overview of the diversity of animal life, with a focus on organisms that do not possess a vertebral column (non-chordates). This may include an exploration of the major phyla and their characteristics.
2. Classification and Taxonomy: Understanding the principles of classification and taxonomy of non-chordate animals, including their evolutionary relationships and hierarchical grouping.
3. Morphology and Anatomy: Studying the external and internal structures of various non-chordate animals, their adaptations, and how these features contribute to their survival and ecological roles.
4. Physiology: Learning about the physiological processes and systems in non-chordate animals, such as digestion, respiration, circulation, excretion, and reproduction.
5. Reproduction and Life Cycles: Examining the reproductive strategies and life cycles of different non-chordate species, including asexual and sexual reproduction methods.
6. Ecology and Behavior: Exploring the ecological interactions and behavioral patterns of non-chordate animals in their natural habitats.
7. Economic and Ecological Importance: Understanding the ecological significance of non-chordates, their roles in ecosystems, and their economic importance for humans (e.g., as food sources or in biomedical research).
8. Environmental Issues: Discussing the conservation and environmental challenges that non-chordate animals face, including threats to their habitats and potential conservation measures.
9. Evolutionary History: Tracing the evolutionary history of non-chordate animals and how they have diversified and adapted over time.
10. Laboratory and Field Techniqu es: Practical aspects of studying non-chordate animals, including laboratory techniques, field sampling, and identification methods.

### Life and Diversity of Animals-Chordates.

1. Identify and classify chordate animals: Students will be able to recognize and categorize different chordate species based on their anatomical, morphological, and physiological characteristics.
2. Understand the evolutionary history of chordates: Students will gain insights into the

evolutionary relationships among different chordate groups, including vertebrates and invertebrate chordates.

3. Describe the anatomical features of major chordate groups: Students will be able to explain the key anatomical features that define each major chordate group, including fishes, amphibians, reptiles, birds, and mammals.
4. Examine the diversity of chordate habitats: Students will explore the various habitats occupied by chordates, from marine environments to terrestrial ecosystems, and understand how their adaptations have allowed them to thrive in diverse conditions.
5. Analyze the ecological roles of chordates: Students will study the ecological roles of different chordate species within their ecosystems and understand their contributions to biodiversity.
6. Investigate chordate physiology and behavior: Students will learn about the physiological mechanisms and behavioral patterns exhibited by chordates, focusing on key functions such as respiration, circulation, reproduction, and locomotion.
7. Discuss conservation challenges and efforts for chordates: Students will understand the conservation issues faced by chordate species due to habitat destruction, pollution, climate change, and other human-related impacts. They will also explore conservation strategies and efforts to protect and preserve these animals and their habitats.
8. Apply critical thinking skills to chordate-related topics: Students will develop critical thinking skills through the evaluation and analysis of scientific literature, case studies, and debates related to chordate biology and conservation.
9. Demonstrate practical knowledge of chordate anatomy: Depending on the course level and format, students may have opportunities to work with chordate specimens, conduct dissections, and apply their knowledge practically.
10. Communicate effectively about chordate biology: Students will be able to articulate their understanding of chordate biology and related topics through oral presentations, written reports, and class discussions.

**Cell Biology:**

1. Understand the fundamental principles of cell biology: Students will develop a comprehensive understanding of the basic concepts and principles that govern cellular structure and function.
2. Describe the structure and organization of cells: Students will be able to describe the structures and organelles found within eukaryotic and prokaryotic cells, and understand their functions.
3. Explain cellular processes: Students will gain knowledge of essential cellular processes, such as cell division, metabolism, signal transduction, and cell communication.
4. Understand cellular biochemistry: Students will learn about the biochemical processes that occur within cells, including enzyme reactions, metabolic pathways, and cellular energy production.
5. Explore cell cycle regulation and cell growth: Students will understand the mechanisms that control cell division and cell growth, including the role of key regulatory proteins.
6. Study cell signaling and communication: Students will learn about cellular signaling pathways and how cells communicate with each other to coordinate various physiological responses.

7. Investigate cell membrane structure and function: Students will gain insights into the structure and functions of cell membranes, including membrane transport, receptor proteins, and cell-cell interactions.
8. Examine cellular genetics: Students will explore the relationship between genes and cell function, including the role of DNA, RNA, and protein synthesis within cells.
9. Analyze cell interactions with the extracellular environment: Students will understand how cells interact with their surroundings, including the extracellular matrix and neighboring cells.
10. Apply microscopy techniques in cell biology: Depending on the course level and resources available, students may have the opportunity to learn and apply various microscopy techniques to study cells and cellular components.
11. Develop critical thinking and experimental skills: Students will enhance their ability to critically analyze scientific literature and experimental data related to cell biology.
12. Relate cell biology to broader contexts: Students will be able to connect cellular processes and functions to broader biological systems and understand the significance of cell biology in various fields, such as medicine, biotechnology, and ecology.
13. Apply ethical considerations in cell biology research: Students will gain awareness of ethical issues related to cell biology research, including the use of animal and human cells in experiments and the implications of cell-based technologies.

**Genetics:**

1. Understanding the principles of inheritance: Students should grasp the fundamental concepts of genetics, including Mendelian inheritance, non-Mendelian inheritance patterns, and the mechanisms of gene transmission from one generation to another.
2. Knowledge of genetic terminology: Students should be familiar with essential genetic terminology, such as genes, alleles, genotypes, phenotypes, chromosomes, and various genetic mutations.
3. Analyzing and interpreting genetic data: Students should be able to interpret genetic data and analyze genetic crosses to determine the genotypes and phenotypes of individuals or populations.
4. Understanding DNA structure and function: Students should comprehend the structure of DNA, its replication process, and how genetic information is encoded and passed on to subsequent generations.
5. Genetic variation and population genetics: Students should learn about genetic variation within and between populations, factors influencing genetic diversity, and the consequences of genetic drift and natural selection.
6. Human genetics: Students should gain insights into human genetics, including patterns of inheritance for specific traits and diseases, genetic counseling, and the impact of genetic variations on human health.
7. Genetic technologies and applications: Students should be aware of various genetic technologies, such as polymerase chain reaction (PCR), gene sequencing, genetic engineering, and their applications in research, medicine, and agriculture.
8. Ethical and social implications: Students should explore the ethical, legal, and social implications of genetic research and technologies, including genetic testing, gene editing, and personalized medicine.

9. Problem-solving skills: Students should develop problem-solving abilities related to genetic analysis, inheritance patterns, and genetic research.
10. Critical thinking and scientific inquiry: Students should foster critical thinking skills and the ability to evaluate scientific literature and genetic research.
11. Communication skills: Students should be able to effectively communicate genetic concepts and research findings through written reports, presentations, or discussions.

**General mammalian physiology:**

The course outcome of a general mammalian physiology course typically aims to provide students with a comprehensive understanding of the physiological functions and mechanisms that govern the bodies of mammals, including humans.

1. Understanding physiological principles: Students should grasp the fundamental principles of mammalian physiology, including homeostasis, cell and tissue function, and the coordination of organ systems.
2. Knowledge of organ systems: Students should have a detailed understanding of the major organ systems in mammals, such as the nervous system, cardiovascular system, respiratory system, digestive system, endocrine system, renal system, and reproductive system.
3. Cellular and molecular physiology: Students should learn about the physiological processes at the cellular and molecular levels, including membrane transport, cellular signaling, enzyme kinetics, and gene regulation.
4. Energy metabolism: Students should understand the principles of energy production and utilization in mammalian cells, including glycolysis, Krebs cycle, oxidative phosphorylation, and other energy pathways.
5. Integration of physiological processes: Students should be able to integrate the functions of different organ systems to understand how the body maintains homeostasis and responds to various internal and external stimuli.
6. Physiological regulation: Students should learn about the mechanisms that regulate physiological processes, such as neural and hormonal control, feedback loops, and circadian rhythms.
7. Physiology of stress and adaptation: Students should gain insights into the physiological responses to stress and the body's adaptive mechanisms to cope with different stressors.
8. Comparative physiology: Students may explore the differences and similarities in physiological processes among different mammalian species, highlighting the principles of evolution and adaptation.
9. Applied physiology: Students should be aware of how physiological knowledge is applied in various fields, such as medicine, sports science, pharmacology, and environmental science.
10. Laboratory skills: Depending on the course format, students may develop practical laboratory skills to conduct experiments related to mammalian physiology, data analysis, and interpretation.
11. Critical thinking and scientific inquiry: Students should foster critical thinking skills and the ability to analyze research literature, interpret experimental results, and understand the limitations of studies in mammalian physiology.
12. Communication skills: Students should be able to effectively communicate complex physiological concepts and research findings through written reports, presentations, or

discussions.

## Environmental biology:

The course outcome of Environmental Biology typically aims to provide students with a comprehensive understanding of the interrelationships between living organisms and their environment.

1. Understanding of Ecological Principles: Students should gain a thorough understanding of fundamental ecological principles, such as the biotic and abiotic factors that shape ecosystems, energy flow, nutrient cycling, and population dynamics.
2. Knowledge of Biodiversity: Students should be able to identify and classify different species, understand the importance of biodiversity for ecological balance, and recognize threats to biodiversity.
3. Awareness of Environmental Issues: Students should be informed about various environmental challenges, such as pollution, habitat destruction, climate change, and their impact on ecosystems and human well-being.
4. Comprehension of Adaptations and Interactions: Students should be able to explain how organisms have adapted to their environments and understand the interactions between different species within ecosystems.
5. Familiarity with Conservation Strategies: Students should be introduced to conservation principles and strategies aimed at preserving biodiversity and protecting natural resources.
6. Analysis of Human Impact: Students should be able to analyze and assess the effects of human activities on the environment and explore sustainable practices to mitigate negative impacts.
7. Fieldwork and Data Collection Skills: Depending on the course, students may develop skills in conducting field studies, collecting ecological data, and analyzing information to draw conclusions.
8. Critical Thinking and Problem-Solving: Students should be able to apply ecological principles and knowledge to critically evaluate environmental issues and propose potential solutions.
9. Communication Skills: Students should be able to effectively communicate scientific information related to environmental biology through oral presentations, written reports, and other mediums.
10. Ethical and Responsible Stewardship: Students should develop an awareness of the ethical considerations associated with environmental biology and be encouraged to become responsible stewards of the environment.

## Applied Zoology:

1. Knowledge of Zoological Principles: Students will acquire a strong foundation in the fundamental principles of zoology, including taxonomy, anatomy, physiology, ecology, evolution, and behavior of animals.
2. Understanding of Animal Diversity: Students will be familiar with the diversity of animal life, including the classification and characteristics of major animal groups.
3. Laboratory and Field Skills: Students will gain practical experience in laboratory techniques, data collection, and analysis. Field skills may include observing, sampling, and

studying animals in their natural habitats.

4. Conservation and Environmental Awareness: Students will develop an understanding of conservation biology and the importance of protecting wildlife and their habitats.
5. Applied Zoological Techniques: Students will learn about various applied techniques used in zoology, such as wildlife management, captive breeding, animal husbandry, and animal behavior research.
6. Animal Health and Welfare: Students will explore the principles of animal health and welfare, including the identification and treatment of diseases, nutrition, and ethical considerations in animal research and handling.
7. Communication and Research Skills: Students will enhance their abilities in scientific writing, data interpretation, and presentation of research findings.
8. Career Readiness: The course may focus on preparing students for various career paths related to applied zoology, such as wildlife biologist, zookeeper, conservation officer, research scientist, or educator.
9. Problem-Solving and Critical Thinking: Students will develop skills in analyzing complex issues related to animals and their environments, proposing solutions, and making informed decisions.
10. Ethical Considerations: Students will be encouraged to think critically about ethical issues surrounding animal use in research, conservation, and human-animal interactions.

**Molecular Biology and Immunology:**

1. Understand the principles of molecular biology:
    - Demonstrate knowledge of the structure and function of DNA, RNA, and proteins.
    - Explain the mechanisms of DNA replication, transcription, and translation.
    - Understand gene regulation and the control of gene expression.
2. Analyze molecular techniques and laboratory methods:
    - Perform and interpret common molecular biology techniques, such as PCR, gel electrophoresis, and DNA sequencing.
    - Analyze and interpret experimental data from molecular biology experiments.
3. Comprehend the molecular basis of genetic diseases:
    - Identify and explain how genetic mutations can lead to various genetic disorders.
    - Understand the principles of genetic inheritance and pedigree analysis.
4. Understand the basics of immunology:
    - Describe the components of the immune system and their roles in defending against pathogens.
    - Explain the processes of immune recognition, activation, and effector responses.
5. Explain the immune response to infections and diseases:
    - Describe the immune response to bacterial, viral, and parasitic infections.
    - Understand the mechanisms of immune-mediated diseases and autoimmune disorders.
6. Discuss the role of immunology in medicine and biotechnology:
    - Explain the principles of vaccination and how vaccines work.

- Understand the use of immunological techniques in diagnostic and therapeutic applications

7. Apply molecular and immunological knowledge to research:

   - Analyze scientific literature in molecular biology and immunology.
   - Design and propose experiments to investigate specific molecular or immunological questions.

8. Develop critical thinking and problem-solving skills:

   - Critically evaluate experimental data and scientific theories in the field.
   - Apply molecular and immunological concepts to address real-world challenges.

# Programme outcome of M.Sc. Mathematics

1. Advanced Mathematical Knowledge: Graduates will possess a deep understanding of advanced concepts and theories in core areas of mathematics, such as real analysis, abstract algebra, complex analysis, topology, differential equations, and numerical analysis.
2. Rigorous Mathematical Reasoning: Graduates will demonstrate the ability to apply rigorous mathematical reasoning and logical thinking in analyzing and solving complex mathematical problems.
3. Research Proficiency: Graduates will acquire research skills and techniques, enabling them to undertake independent investigations and contribute to the advancement of mathematical knowledge.
4. Multidisciplinary Application: Graduates will be adept at applying mathematical methods and techniques to solve problems across various interdisciplinary fields, including physics, engineering, computer science, economics, and other related disciplines.
5. Computational and Numerical Skills: Graduates will develop proficiency in computational and numerical methods, enabling them to solve practical problems using computer-based approaches.
6. Advanced Mathematical Modeling: Graduates will be able to formulate mathematical models for real-world problems and interpret the results to draw meaningful conclusions.
7. Communication Skills: Graduates will demonstrate effective communication skills, both written and oral, enabling them to articulate complex mathematical concepts and ideas to diverse audiences.
8. Collaborative Abilities: Graduates will develop teamwork and collaboration skills, enabling them to work effectively in multidisciplinary environments and contribute constructively to group projects and research collaborations.
9. Ethical Awareness: Graduates will recognize the ethical responsibilities associated with mathematical research and practice, demonstrating integrity and professionalism in their academic pursuits.
10. Lifelong Learning: Graduates will cultivate a thirst for continuous learning, embracing new developments in mathematics and related fields, and adapting to emerging challenges and opportunities.

**1. Algebra I :**

- Understand the fundamental concepts of groups, rings, and fields.
- Analyze the properties of group operations, subgroups, and cosets.
- Learn about group homomorphisms, isomorphisms, and factor groups.
- Study the properties of rings, integral domains, and fields.
- Explore algebraic structures and their applications.

**2. Real Analysis I:**

- Develop a solid understanding of the concepts of limits, continuity, and differentiability of real functions.
- Analyze the convergence and divergence of sequences and series of real numbers.
- Study properties of real-valued functions and their applications.
- Learn the concept of Riemann integration and its properties.
- Explore topics related to metric spaces and topology.

**3. Topology I:**

- Develop an understanding of basic point-set topology and set-theoretic concepts.
- Study topological spaces, open and closed sets, continuity, and compactness.
- Explore connectedness and separation axioms in topological spaces.
- Understand basic topological properties and transformations.

**4. Ordinary Differential Equations (ODE):**

- Study different types of ordinary differential equations and their solutions.
- Learn techniques for solving first-order and higher-order ODEs.
- Understand existence and uniqueness theorems for ODEs.
- Explore applications of ODEs in various areas, such as physics and engineering.

**5. Integral Equations:**

- Understand the concept of integral equations and their classification.
- Study different methods for solving integral equations.
- Learn about the Fredholm and Volterra integral equations and their properties.
- Explore applications of integral equations in mathematical modeling.

1. **Algebra II:**

- Deepen the understanding of advanced topics in group theory, ring theory, and field theory.
- Study advanced properties of groups, including solvable groups and simple groups.
- Explore topics in ring theory such as unique factorization domains and polynomial rings.
- Understand advanced concepts in field theory, such as Galois theory and field extensions.

**2. Real Analysis II:**

- Explore advanced topics in real analysis, including Lebesgue integration and measure theory.
- Study the convergence of sequences and series of functions.
- Understand different modes of convergence and their relationships.
- Analyze advanced properties of real-valued functions and their applications.

**3. Topology II:**

- Deepen the understanding of advanced topics in general topology.
- Study topological spaces, compactness, and connectedness in more depth.
- Explore separation axioms and metrizability.
- Learn about topological groups and other advanced topological structures.

**4. Differential Geometry:**

- Study curves and surfaces in 2D and 3D spaces.
- Understand tangent vectors, normal vectors, and curvature of curves and surfaces.
- Explore the concept of geodesics and the curvature of surfaces.
- Analyze advanced topics in Riemannian geometry and applications in general relativity.

**5. Classical Mechanics:**

- Study the principles of classical mechanics, including Newton's laws and Lagrange's equations.
- Explore the motion of particles and rigid bodies in three dimensions.
- Understand conservation laws, such as energy and momentum.
- Analyze the motion of oscillating systems and central force problem

**1. Complex Analysis:**

- Deepen the understanding of advanced topics in complex analysis.
- Study conformal mappings and their applications.
- Explore advanced topics in complex integration, such as Cauchy's residue theorem and contour integration.
- Understand analytic continuation and its significance in complex analysis.

**2. Functional Analysis:**

- Study Banach spaces, Hilbert spaces, and their properties.
- Explore linear operators on normed and inner product spaces.
- Understand spectral theory and applications of functional analysis in mathematical physics and engineering.

**3. Mathematical Methods:**

- Explore advanced mathematical techniques used in various branches of science and engineering.
- Study topics like partial differential equations, Fourier analysis, and special functions.
- Understand the use of mathematical methods in solving real-world problems.

**4. General Relativity:**

- Study the theory of general relativity and its mathematical formulation.
- Explore the geometry of spacetime and the concept of curvature.
- Understand the Einstein field equations and their solutions.
- Explore astrophysical applications of general relativity, such as black holes and gravitational waves.

**5. Operational Research I:**

- Study the fundamentals of operational research and its applications in decision-making.
- Explore linear programming and optimization techniques.
- Understand network optimization and transportation problems.
- Analyze the use of operational research in resource allocation and project planning.

1. **Dynamical Systems:**

- Study the theory of dynamical systems and their behavior over time.
- Understand fixed points, stability analysis, and bifurcations.
- Explore chaos theory and its applications in various fields.
- Analyze the qualitative behavior of differential equations and maps.

**2. Partial Differential Equations (PDE):**

- Deepen the understanding of advanced topics in partial differential equations.
- Study elliptic, parabolic, and hyperbolic PDEs and their solutions.
- Explore boundary value problems and initial value problems for PDEs.
- Understand the theory of distributions and their applications to PDEs.

**3. Advanced Numerical Methods:**

- Study advanced numerical techniques for solving differential equations and mathematical problems.
- Explore finite difference methods, finite element methods, and spectral methods.
- Understand error analysis and stability of numerical algorithms.
- Analyze the implementation and performance of numerical methods on computers.

**4. Cosmology:**

- Study the physical and mathematical principles underlying the universe's large-scale structure and evolution.
- Explore cosmological models, such as the Big Bang model and inflationary cosmology.
- Understand the cosmic microwave background radiation and its significance.
- Analyze dark matter, dark energy, and the fate of the universe.

**5. Operational Research II:**

- Deepen the understanding of advanced topics in operational research and optimization.
- Study nonlinear programming, integer programming, and combinatorial optimization.
- Explore game theory and its applications in decision-making and economics.
- Understand the use of operational research in supply chain management and logistics.