



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

B.Sc. Zoology Semester VII (Honours and Honours with research)



SARDAR PATEL UNIVERSITY

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

Vallabh Vidyanagar
Gujarat

Academic Program Structure

&

Curriculum

B.Sc. SEM-7 Zoology Honours and Honours with Research

NEP-2020



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B.Sc. Zoology Semester VII (B.Sc. Honours)

Sr. No.	Component	Course code	Course title	Credit	CCE	SEE	Total
1	Major Courses	US07HMAZOO01	Cell Biology	4 *3=12	50*3 =150	50*3 =150	100*3=300
2		US07HMAZOO02	Principles of Immunology				
3		US07HMAZOO03	Zoology Practical				
4	Minor	US07HMIZOO01	Animal Cell Biology and Human Physiology	2	25	25	50
5		US07HMIZOO02	Zoology Practical	2	25	25	50
6	OJT (On the Job Training)	US07HOJZOO01	On the Job Training	6			
OR							
7	OJT (On the Job Training)	US07OJZOO02	Research Methodology	4	25	25	50
8		US07OJZOO03	Principles of Ecology	2	25	25	50
Total				22			

B.Sc. Zoology Semester VII (B.Sc. Honours with Research)

Sr. No.	Component	Course code	Course title	Credit	CCE	SEE	Total
1	Major Courses	US07HMAZOO01	Cell Biology	4*3=12	50*3=150	50*3=150	100 * 3=300
2		US07HMAZOO02	Principles of Immunology				
3		US07HMAZOO03	Zoology Practical				
4	Minor	US07HMIZOO01	Animal Cell Biology and Human Physiology	2	25	25	50
		US07HMIZOO02	Zoology Practical	2	25	25	50
5	RP (Research Project)	US07HRPZOO02	Research Project	6			
Total				22			



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B.Sc. Zoology Semester VII (Honours and Honours with research)

B. Sc. (Zoology) Semester VII

Course Code	US07HMAZOO01	Title of the Course	Cell Biology
Total Credits of the Course	04	Hours per Week	04

Course Objectives:

1. To provide foundational knowledge of cell structure, organization, and major organelles in prokaryotic and eukaryotic cells.
2. To develop understanding of the structure and function of the plasma membrane and transport mechanisms.
3. To introduce the structural and functional role of cytoskeleton and basic principles of cell communication.
4. To explain the processes of cell cycle, mitosis, meiosis, and basic regulation mechanisms.
5. To familiarize students with introductory concepts of apoptosis and cancer biology at the undergraduate level.

Course Outcomes:

After successful completion of the course, the learner will be able to:

1. Describe the structure and functions of major cell organelles and compare prokaryotic and eukaryotic cells.
2. Explain membrane structure and demonstrate understanding of passive and active transport processes.
3. Illustrate the organization of cytoskeletal components and summarize their role in cell shape and movement.
4. Outline the stages of the cell cycle and differentiate between mitosis and meiosis.
5. Interpret basic concepts of apoptosis and cancer biology and relate them to cellular regulation mechanisms.

Course Content

Unit – I : Cell Structure and Organization

Cell theory and types of cells (Prokaryotic and Eukaryotic)

Overview of plant and animal cell

Structure and function of nucleus,
nucleolus Endoplasmic reticulum, Golgi
apparatus

Lysosomes, ribosomes, peroxisomes

Mitochondria and chloroplast (basic structure and function)



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Unit – II : Cell Membrane and Transport

Fluid mosaic model
Membrane structure and components
Passive and active transport
Endocytosis and exocytosis
Cell junctions (tight, gap, desmosomes)
Basics of extracellular matrix (ECM)

Unit – III : Cytoskeleton and Cell Communication

Microfilaments, microtubules, intermediate filaments (basic structure & function)
Role in cell shape and movement
Basic cell signalling concept
Types of receptors (overview)
Second messengers (cAMP, Ca²⁺)

Unit – IV : Cell Cycle, Cell Division and Cancer

Cell cycle phases (G1, S, G2, M)
Mitosis and meiosis (overview)
Regulation of cell cycle (basic idea of cyclins)
Programmed cell death (apoptosis – concept only)
Introduction to cancer biology (basic terms, oncogene, tumor suppressor gene)

Teaching–Learning Methodology

- Classroom lectures and discussions
- ICT-enabled teaching methods
- Laboratory demonstrations and practical sessions
- Field visits and case studies
- Student seminars, assignments, and presentations

Suggested References

1. Cell Biology – De Robertis
2. Molecular Biology of the Cell – Alberts
3. Cell Biology-Karp
4. Online Resources: NPTEL, BISAG, SWAYAM



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B.Sc. Zoology Semester VII (Honours and Honours with research)

Course Code	US07HMAZOO02	Title of the Course	Principles of Immunology
Total Credits of the Course	04	Hours per Week	04

Course Objectives:

1. To introduce fundamental concepts of the immune system, including innate and adaptive immunity and their components.
2. To explain the structure, types, and functions of antigens and antibodies and their interactions.
3. To develop understanding of antigen processing, MHC molecules, complement system, and cytokine regulation.
4. To familiarize students with immune responses including hypersensitivity, autoimmunity, transplantation, and immunodeficiency.
5. To provide basic knowledge about vaccines and the role of immunity in disease prevention.

Course Outcomes

After successful completion of the course, the learner will be able to:

1. Describe the components of innate and adaptive immunity and differentiate between humoral and cell-mediated immune responses.
2. Explain antigen–antibody interactions and analyze factors affecting immunogenicity.
3. Illustrate the mechanisms of antigen processing and presentation through MHC I and MHC II pathways.
4. Classify hypersensitivity reactions, autoimmune disorders, transplantation reactions, and immunodeficiency diseases with examples.
5. Summarize different types of vaccines and explain their role in disease prevention and public health

Course Content

Unit – I : Immune System and its components:

Innate immunity: components and defensive barriers of innate immunity. Adaptive immune system: Components and attributes of acquired immunity, humoral and cell-mediated immunity, Instructional and clonal selection theory; active and passive immunity, primary and secondary immune response. Cells and Tissues of the Immune System



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Unit – II : Antigens, Immunogens and Antibodies:

Antigens and immunogens; factors affecting immunogenicity; antigenic determinants (B- and T-cell epitopes); concepts of antigen recognition by B- and T-cells. Structure and function of different classes of antibodies, Antigen Antibody reactions

Unit – III : Antigen Processing and Presentation:

Structure and functions of MHC (MHC I & MHC II); endogenous and exogenous pathways of antigen processing and presentation; Complement System: Properties and functions of cytokines; Pathways of complement activation and its biological consequences; Cytokines and regulation

Unit – IV : Role of the immune system in the prevention of Diseases:

Transplantation immunology, Hypersensitivity Types and mechanisms with suitable examples, autoimmunity, immune dysfunctions, and immunodeficiency with suitable examples; Vaccines and their types.

Teaching–Learning Methodology

- Classroom lectures and interactive discussions
- ICT-enabled teaching methods
- Laboratory demonstrations and case studies
- Student seminars and presentations
- Assignments and project-based learning

Suggested References

1. Immunology-Kuby
2. Cellular and Molecular Immunology-Abbas
3. Janeway's Immunobiology-Murphy and Weaver



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Course Code	US07HMAZOO03	Title of the Course	Zoology Practical
Total Credits of the Course	04	Hours per Week	08

Course Objectives:

1. To learn basic laboratory skills in cell biology and microscopy by observing cell structures and cell division.
2. To perform simple molecular and biochemical techniques such as detection of biomolecules and DNA isolation safely and correctly.
3. To understand and carry out basic blood tests and other hematological laboratory techniques.
4. To understand basic immunology through experiments involving antigen–antibody reactions.
5. To study enzyme activity and physiological processes and relate experimental results to cell function and health.

Course Outcomes

After successful completion of the course, the learner will be able to:

1. Use a microscope to observe cell structure, mitosis, meiosis, and special chromosomes.
2. Perform basic biochemical and molecular tests, including detection of biomolecules and DNA isolation.
3. Conduct and understand basic blood tests such as blood grouping, haemoglobin estimation, and leukocyte counts.
4. Carry out simple immunological tests and understand antigen–antibody reactions.
5. Study enzyme activity and basic physiological processes and relate results to biological concepts.



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B.Sc. Zoology Semester VII (Honours and Honours with research)

Course Content Section –

I

1. Study of animal cell structure using permanent slides and charts
2. Observation of mitosis in onion root tip
3. Observation of meiosis in grasshopper testes
4. Demonstration of mitochondria from blood cells
5. Demonstration of Barr Body
6. Demonstration of apoptosis using multimedia/charts Programmed cell death
7. Vital staining i) Nucleus; ii) Mitochondria
8. Demonstration of role of plasma membrane in regulating the internal environment.
9. Detection of Carbohydrates, Proteins, and Lipids in Cells.
10. Isolation of DNA.

Section – II

1. Total Leukocyte Count
2. Polytene chromosomes
3. Blood Grouping
4. Differential Leukocyte Count
5. Widal Test
6. Immunodiffusion in one/two dimension/s
7. Titration of antibody
8. Demonstration of ELISA
9. Blood Haemoglobin Estimation
10. Phagocytosis by Neutrophils (In Vitro)
11. Salivary Amylase Activity (Effect of pH/Temp)

Teaching–Learning Methodology

- Laboratory demonstrations and practical sessions
- Microscopic observation and slide study
- ICT-enabled teaching using videos and animations
- Field visits and biodiversity surveys
- Preparation of charts, reports, and project assignments

Suggested References

1. Practical Zoology – P.S. Verma
2. Cell Biology Practical Manual – C.B. Powar
3. Molecular Biology Techniques – Sambrook and Russell
4. Practical Biochemistry – David Plummer
5. Online Resources: NPTEL, BISAG, SWAYAM



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Course Code	US07HMIZOO01	Title of the Course	Animal Cell Biology and Human Physiology
Total Credits of the Course	02	Hours per	04

Course Objectives:

1. To understand the structure and functions of animal cells and cellular organelles.
2. To study cell division, cell signalling, and applications of stem cells in biology and medicine.
3. To understand the organization and physiological functioning of major human body systems.
4. To develop knowledge regarding endocrine regulation, nervous coordination, and homeostasis in humans.

Course Outcomes

After successful completion of the course, the learner will be able to:

1. Explain the structure and functions of animal cells and cell organelles.
2. Understand cell division, stem cell biology, and cellular communication mechanisms.
3. Describe the organization and physiological functioning of major human body systems.
4. Explain the role of endocrine glands and hormones in maintaining homeostasis.
5. Understand nervous coordination and transmission of nerve impulses in humans

Course Content

Unit – I : Animal Cells

Introduction to animal cells, structure and functions of animal cells, detailed study of cell organelles including nucleus, mitochondria, endoplasmic reticulum, Golgi bodies, lysosomes, and ribosomes. Cell membrane structure and transport mechanisms, cell division through mitosis and meiosis, cell cycle and its regulation. Stem cells and their applications in biology and medicine.



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Unit – II : Human Physiology

Introduction to human physiology and organization of human body systems, classification of bones of human body, structure and functions of bones and joints. Detailed study of endocrine glands and hormones including pituitary, thyroid, parathyroid, adrenal glands, pancreas, and gonads. Functions and regulation of hormones in growth, metabolism, reproduction, and homeostasis. Introduction to pheromones and prostaglandins and their physiological significance.

Teaching–Learning Methodology

- Classroom lectures and interactive discussions
- ICT-enabled teaching methods
- Laboratory demonstrations and model-based learning
- Student seminars and presentations
- Assignments and project-based learning

Suggested References

1. Cell Biology – De Robertis
2. Molecular Biology of the Cell – Alberts
3. Human Physiology – Guyton and Hall
4. Animal Physiology – Rastogi
5. Cell and Molecular Biology – Powar
6. Principles of Anatomy and Physiology – Tortora and Derrickson
7. Online Resources: NPTEL, BISAG, SWAYAM



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Course Code	US07HMIZOO02 (P)	Title of the Course	Zoology Practical
Total Credits of the Course	02	Hours per	04

Course Objectives:

1. To develop practical skills related to animal cell biology and human physiology.
2. To familiarize students with microscopic observation and physiological measurements.
3. To understand the structure and functions of cells, tissues, and human organ systems through practical study.
4. To enhance observational, analytical, and scientific reporting skills.

Course Outcomes

After successful completion of the course, the learner will be able to:

1. Identify cellular structures and stages of cell division.
2. Understand the process of mitosis and meiosis through microscopic observation.
3. Identify major bones and endocrine glands of the human body.
4. Measure physiological parameters such as pulse rate and blood pressure.
5. Explain reflex action and nervous coordination in humans.
6. Develop practical and analytical skills in zoological studies.

Course Content

1. Study of animal cell structure using permanent slides and charts.
2. Observation of mitosis in onion root tip.
3. Observation of meiosis in grasshopper testes.
4. Demonstration of apoptosis using multimedia/charts/models.
5. Identification of different bones of the human body.
6. Study of endocrine glands using slides/charts/models.
7. Measurement of pulse rate and blood pressure.
8. Study of reflex action and reflex arc.

Teaching–Learning Methodology

- Laboratory demonstrations and practical sessions
- Microscopic observation and slide study
- Use of charts, models, and multimedia tools
- Group discussions and interactive learning
- Preparation of practical records and assignments

Suggested References

1. Practical Zoology – P.S. Verma
2. Cell Biology – De Robertis
3. Human Physiology – Guyton and Hall
4. Practical Human Physiology – C.L. Ghai
5. Animal Physiology – Rastogi
6. Online Resources: NPTEL, BISAG, SWAYAM



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B.Sc. Zoology Semester VII (Honours and Honours with research)

Course Code	US07HOJZOO02	Title of the Course	Research Methodology
Total Credits of the Course	04	Hours per Week	04

Course Objectives:

1. To introduce the basic concepts and importance of research in zoological sciences.
2. To develop understanding regarding research design and experimental planning.
3. To familiarize students with methods of data collection and biological sampling techniques.
4. To enhance scientific thinking, observation, and analytical skills in zoological research.

Course Outcomes

After successful completion of the course, the learner will be able to:

1. Understand the basic concepts and importance of research in zoology.
2. Identify research problems and formulate hypotheses for biological studies.
3. Explain different research designs and experimental methods.
4. Apply suitable methods for collection and analysis of biological data.
5. Prepare scientific reports and present zoological research findings effectively.
6. Develop scientific attitude and analytical skills for higher studies and research

Course Content

Unit – I : Introduction to Research and Research Design

Introduction to research and its importance in zoological sciences, types of research including basic, applied, experimental, and field-based research. Research process including identification and definition of research problems related to Zoology, Literature review and literature collection, need for review of literature, research reading, and consulting scientific source materials including journals, books, and online databases, Introduction to experimental design including observation, hypothesis, and null hypothesis. Types of experimental designs used in zoological and environmental studies.

Unit – II : Methods of Data Collection and Biological Research Techniques

Methods of data collection in zoological research including collection of primary and secondary data; Observation method and field observation techniques in animal studies.

Interview method and preparation of questionnaires and schedules for biodiversity surveys and public health studies; Selection of appropriate methods for collection of biological and ecological data; Recording, tabulation, and presentation of biological data using tables, charts, and graphs.



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Unit III: Biological Research Techniques and Data Interpretation

Introduction to biological research techniques used in zoology and environmental studies. Field survey methods, biodiversity assessment, wildlife census techniques, and sampling methods used in animal studies. Collection and documentation of biological specimens and ecological observations.

Introduction to data tabulation, graphical representation, and interpretation of biological data using tables, charts, and graphs; Basic concepts of biostatistics and their applications in zoological research; Introduction to mean, median, mode, standard deviation. Use of computer applications for biological data analysis and presentation

Unit IV: Scientific Communication and Research Ethics

Structure of scientific paper (title, abstract, introduction, methods, results, discussion, references); Scientific writing skills; Research proposal basics; Literature review techniques; Citation styles (APA/MLA); Research ethics; Plagiarism – types and prevention; Introduction to research databases (Google Scholar, PubMed, Scopus – basic awareness); Basics of laboratory notebook maintenance.

Teaching–Learning Methodology

- Classroom lectures and interactive discussions
- ICT-enabled teaching methods
- Demonstration of research tools and sampling techniques
- Field-based learning and survey methods
- Student seminars, assignments, and project work

Suggested References

1. Research Methodology – C.R. Kothari
2. Biostatistics and Research Methodology – P. Ramakrishnan
3. Fundamentals of Research Methodology – S.C. Gupta
4. Practical Zoology – P.S. Verma
5. Ecology and Field Biology – Odum
6. Online Resources: NPTEL, BISAG, SWAYAM



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Course Code	US07HOJZOO03	Title of the Course	Principles of Ecology
Total Credits of the Course	02	Hours per Week	02

Course Objectives:

1. To introduce basic concepts, levels of ecological organization, and environmental factors.
2. To explain population characteristics, growth patterns, and regulation mechanisms.
3. To understand community structure, species interactions, and ecological succession.
4. To describe ecosystem structure, energy flow, and major biogeochemical cycles.
5. To develop awareness of ecosystem types, human impacts, and principles of sustainability.

Course Outcomes

After successful completion of the course, the learner will be able to:

1. Define and explain levels of ecological organization and identify abiotic and biotic factors affecting organisms.
2. Analyze population growth models and interpret population regulation mechanisms.
3. Describe species interactions, community structure, and ecological succession processes.
4. Explain energy flow, trophic levels, and biogeochemical cycles in ecosystems.
5. Evaluate human impacts on ecosystems and propose basic strategies for conservation and sustainability.

Course Content

Unit – I : Population and Community Ecology

Levels of ecological organization; Abiotic and biotic factors; Population attributes (density, natality, mortality, dispersal); Population growth models (exponential & logistic); Carrying capacity; r- and K-selection; Life tables and survivorship curves; Community structure; Species interactions (competition, predation, mutualism, parasitism); Food chains and food webs; Ecological succession

Unit – II : Ecosystem Ecology and Human Impact

Ecosystem structure and function; Energy flow and trophic levels; Ecological pyramids; Primary productivity; Biogeochemical cycles (Carbon, Nitrogen, Water –



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basic); Major ecosystem types (forest, grassland, aquatic); Human impacts (climate change, pollution, habitat loss); Ecosystem services and sustainability

Teaching–Learning Methodology

- Classroom lectures and interactive discussions
- ICT-enabled teaching methods
- Laboratory demonstrations and model-based learning
- Student seminars and presentations
- Assignments and project-based learning

Suggested References

1. Fundamentals of Ecology-Odum
2. Principles of Ecology- Verma and Agarwal
3. Environmental Biology- PD Sharma
4. Ecology and Environment- Bhattacharya
5. Online Resources: NPTEL, BISAG, SWAYAM