

**SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR**



**Programme: MSc (CBCS)
Syllabus with effective from: JUNE-2017**

**ZOOLOGY
Semester: I**

M. Sc. Zoology				
Semester	I	II	III	IV
Core I (4 Credits)	Evolutionary Biology and Biodiversity (PS01CZOO21)	Developmental Biology (PS02CZOO21)	Human Physiology (PS03CZOO21)	Animal Biotechnology (PS04CZOO21)
Core II (4 Credits)	Bioinstrumentation (PS01CZOO22)	Toxicology (PS02CZOO22)	Biology of Animal Behaviour (PS03CZOO22)	Molecular and Applied Endocrinology (PS04CZOO22)
Core III (4 Credits)	Cell Biology (PS01CZOO23)	Fundamentals of Immunology (PS02CZOO23)	Aquaculture Technologies (PS03CZOO23)	Lab I (PS04CZOO23) Practicals based on PS04CZOO21 and PS04CZOO22
Core IV (4 Credits)	Lab I (PS01CZOO24) Practicals based on PS01CZOO21 and PS01CZOO22	Lab I (PS02CZOO24) Practicals based on PS02CZOO21 and PS02CZOO22	Lab I (PS03CZOO24) Practicals based on PS03CZOO21 and PS03CZOO22	
Core V (4 Credits)	Lab II (PS01CZOO25) Practicals based on PS01CZOO23 and PS01EZOO2X	Lab II (PS02CZOO25) Practicals based on PS02CZOO23 and PS02EZOO2X	Lab II (PS03CZOO25) Practicals based on PS03CZOO23 and PS03EZOO2X	
Elective I (4 Credits)	Biostatistics (PS01EZOO21)	Biological Chemistry (PS02EZOO21)	Molecular Biology (PS03EZOO21)	Lab II (PS04EZOO21) Practicals based on PS04EZOO2X and

				PS04EZOO2X
Elective II (4 Credits)			Omics and Computational Biology (PS03EZOO22)	Dissertation (PS04EZOO22) 12 Credits
Elective III (4 Credits)				Nutritional and Clinical Biochemistry (PS04EZOO23)
Elective IV (4 Credits)				Microtechniques (PS04EZOO24)

PS01CZOO21: Evolutionary Biology and Biodiversity

Unit 1:

Introduction to Evolutionary Biology: meaning and importance of evolution in biology. A brief history of life. The development of evolutionary theory- Lamarckism, Darwinism, Natural selection, Neo-Darwinism and Mutation theory.

Evolution of diseases: some examples.

Unit 2:

Variations- nature and types. Mechanisms that decrease and increase variations (natural selection, genetic drift, mutation, recombination and gene flow). Speciation:

Modes of speciation, isolating mechanisms, speciation in time.

Unit 3:

Macro and micro-evolution: definitions, mechanisms and importance. Evidences, patterns of evolution and extinctions over the geological period. Phylogeny: introduction and concepts of phylogeny. Phylogenetic trees, cladistics and phylogenetic reconstructions, hierarchy of species, transitional forms and molecular phylogeny.

Biodiversity: Genetic, species and ecosystem diversity. Biodiversity at global, national levels. Biogeographic classification of India, India as a mega diversity nation.

Unit 4:

National Parks, Wild life Sanctuaries and Biosphere Reserves, Hotspots of Biodiversity. Threats to biodiversity- habitat loss, poaching and man-wildlife conflicts. Endangered and Endemic species of India: Common plant and animal species.

Conservation of Biodiversity, *insitu* and *exsitu* conservation, Keystone species, measurement of biodiversity. Environmental Priorities, strategies and Environmental Legislation (Acts) in India, Environmental Impact Assessment. Bioremediation: Concept need and scope, environmental applications.

Reference Books:

- The theory of Evolution- J. Maynard Smith
- Molecular Evolution and Origin of Life- Widney W. Fox and Klous Dose
- Animal species and their evolution- A.J. Cain
- 29+ Evidences for Macroevolution- Douglas Theobald
(<http://www.talkorigins.org/faqs/comdesc/>)
- Textbook for Environmental Studies- Erach Bharucha, UGC, New Delhi (2004)
- Environmental Biology- K.C. Agrawal
- Ecology & Environment- P.D.Sharma
- Biodiversity- E.O. Wilson
- The Biology of Diversity- M.Kato
- The Diversity of Life- E.O. Wils
- Population, Species and Evolution- Ernst Mayr

PS01CZOO22: Bioinstrumentation

Unit I

Visualization techniques:

Principle of working and applications of bright field microscopy, phase contrast microscopy, fluorescence microscopy, confocal microscopy, scanning and transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy. Principle and applications of cytophotometry and flow cytometry.

Unit II

Separation techniques:

Basic principle and application of Differential, density and ultracentrifugation
Principle and applications of Native-PAGE, SDS-PAGE, Agarose and 2D gel electrophoresis. Capillary electrophoresis and its applications.
Principle, methodology and applications of gel – filtration, ion –exchange and affinity chromatography; Thin layer and High Performance Thin Layer Chromatography. Gas chromatography, High performance liquid chromatography and FPLC.

Unit III

Spectroscopy

Principle, instrumentation and applications of UV, Visible, IR (including FTIR and ATR), AAS, NMR, fluorescence and CD spectroscopy.

Unit IV

Principle and applications of tracer technique in biology:

Radioactive Isotopes and half-life of isotopes; Effect of radiation on biological system; autoradiography; cerenkov radiation; radiation dosimetry; ionization and scintillation based detection and quantification of radioactivity.

Biosensors: Principle, types and applications.

Principle of biophysical methods used for analysis of biopolymer structure: X ray diffraction and mass spectrometry.

References Books:

1. Instrumental method of chemical analysis: Sharma B K
2. Instrumental methods of analysis: D A Skoog
3. An introduction to practical Biochemistry: Plummer
4. Instrumentation: Chatwal and Anand
5. Modern experimental Biology: Boyer

PS01CZOO23: Cell Biology

Unit 1:

Biomembranes and Cytoskeleton:

Biomembrane: The lipid bilayer, Molecular composition of membrane lipids and membrane proteins, Membrane structure of RBC, Membrane Transport, Electrical properties of membrane.

Cytoskeleton: Microfilaments, intermediate filaments and microtubules –structure and dynamics; Microtubules and mitosis; Cell movements; Intracellular transport- role of kinesin and dynein; Role of cytoskeleton in signal transduction mechanisms

Unit2:

Cell –Cell signaling: Cell surface receptors; Second messenger system; G protein coupled signal transduction pathway. cAMP dependent protein kinases, Phosphoinositide pathway, Enzyme linked cell surface receptors –Receptor Tyrosine Kinase – Ras- MAP kinase pathways; Signaling from plasma membrane to nucleus.

Unit 3:

Cell – Cell and Cell matrix adhesion and communication: Ca⁺⁺ dependent and Ca⁺⁺ independent homophilic cell-cell adhesion; Cell junctions and adhesion molecules. Integrins; Extracellular matrix: Collagen and non-collagen components ; Movement of leukocytes into tissues

Unit 4:

Cell Cycle: Cyclins and cyclin dependent kinases, Regulation of CDK – cyclin activity; Cell cycle control in mammalian cells; Checkpoints in cell cycle regulation, Mitosis, Meiosis.

Intracellular protein traffic: Protein synthesis on free and bound polysomes; Uptake into ER; Membrane proteins; Golgi sorting; Post- translational modifications; Trafficking mechanisms.

Reference Books:

- Molecular Cell Biology, J. Darnell, H. Lodish and D. Baltimore Scientific American Book, Inc. USA
- Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J. D. Watson. Garland Publishing Inc. New York.
- Cell and Molecular Biology. Concepts and Experiments, Gerald Karp. John Wiley and Sons, Inc. New York.
- Essentials of Cell and Molecular Biology. De Robertis E. D. P. and De Robertis E. M. F.
- Basic Histopathology. A Colour Atlas and Text. Paul Wheater, George Burkitt, Alan Stevens and James Lowe. ELBS with Churchill Livingstone.

PS01CZOO24: Lab I Practicals based on PS01CZOO21 and PS01CZOO22

PS01CZOO25: Lab II Practicals based on PS01CZOO23 and PS01EZOO2X

PS01CZOO26: Viva

PS01EZOO21: Biostatistics

Unit - I

Definition of Biostatistics

Data Collection:

Types of Biological Data:

Qualitative (Categorical) Data: Nominal and Ordinal Data

Quantitative (Numerical) Data: Discrete and Continuous Data

Methods of Collecting Data:

Survey Method: Concept of a statistical population and sample from a population; Methods of drawing sample from the population, Simple Random Sampling (SRS), Stratified Random Sampling, Cluster Sampling; Experimental Method

Presentation:

Construction of frequency distribution (Simple or Discrete and Grouped): Rules for constructing Grouped frequency distribution

Diagrammatic Presentation: Bar Diagram (Chart), Simple, Sub – divided (Component), Percentage, Multiple, Pie Chart

Graphical Presentation: Line Graph, Histogram (For uniform class width only), Frequency Polygon, Frequency Curve, Ogives or Cumulative Frequency Curves

Descriptive Statistics:

Measures of Central Tendency (Averages): Mean or Arithmetic Mean, Median, Mode, Partition Values (For Raw and Grouped Data), Quartiles, Deciles, Percentile, Partition values using graphs (Ogives).

Measures of Dispersion (Variation): Range, Quartile Deviation (Q.D), Inter Quartile Range (IQR), Standard Deviation (SD) and Variance, Coefficient of Variation (C.V), Box – and – Whisker Plot.

Measures of Skewness and Kurtosis: Karl – Pearson's Coeff. of Skewness, Bowley's Coeff. Of Skewness, Kurtosis (Definition Only).

Unit - II

Probability and Probability Distributions:

Elements of Probability theory: Concept, Classical definition of Probability, Laws of Probabilities (Statements Only), Conditional Probability, Examples

Probability Distributions: Binomial Distribution. Definition, Conditions for applicability of Binomial Distribution, Examples applicable in the field of Biosciences; **Normal Distribution**, Definition (Normal and Standard Normal Distribution), Properties of Normal Distribution, Examples applicable in the field of Biosciences

Unit - III

Correlation and Regression Analysis:

Correlation: Meaning, Types of Correlation, Positive, Negative, Non – Sense or Spurious, Methods of studying correlation, Scatter Plot (diagram) method, Karl-Pearson's Correlation Coefficient (Product Moment) Method; Properties of Correlation Coefficient

Coefficient of determination and its meaning: Spearman's Rank Correlation Coefficient; Properties of Rank Correlation Coefficient

Regression: Meaning, Properties of Regression Coefficients, Applications in the field of Biosciences

Testing Of Hypothesis: Contingency tables, Goodness of Fit

Unit - IV

Large Sample Test: Z - test for (Single) population proportion; Z - test for difference between two population proportions; Z - test for (Single) population mean; Z - test for difference between two population means

Small Sample Test: t – test for (Single) Population Mean, t – test for difference between two population means (Unpaired t-test), t – test for difference between two population means (Paired t-test)

Analysis Of Variance (ANOVA) : One – Way Classification , Two – Way Classification

Reference Books:

- Fundamentals of statistics by S.C. Gupta
- Principles of Biostatistics by Marcello Pagano and Kimberlee Gaurea
- Biostatistics : A Foundation For Analysis in the Health Sciences by Daniel, Wayne(Seventh Edition), Wiley India Pub.