Master of Science (Zoology)
M.Sc. Zoology Semester I

Course Code	PS01EZOO52	Title of the Course	Biostatistics
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	1. Recognize the importance of data collection and its role in determining scope of inference. 2. Understanding of interval estimation and hypothesis testing. 3. Choose and apply appropriate statistical methods for analyzing one or two variables. 4. Use technology to perform descriptive and inferential data analysis for one or two variables. 5. Interpret statistical results correctly, effectively, and in context. 6. Appreciate the power of data. 7. To learn explain how statistical techniques are incorporated in the analysis of biological research data and its presentation. 8. Able to create graphs using Stata to communicate important information about data, and interpret these graphs. 9. Produce a statistical summary of continuous, categorical or censored survival data in a single sample using Stata, and interpret it. 10. Explain fundamental concepts in the design and analysis of medical studies, including the difference between observational and experimental studies, the unit of randomization in randomized studies, the outcome measure of a study, the comparability of the control group or control population, and adjustment for confounding. 11. Explain the concept of a random, representative sample from a population. 12. Explain the logic behind statistical confidence intervals and hypothesis tests. 13. Explain the logic behind parametric tests, permutation tests, (bootstrap estimates of variability and bootstrap confidence intervals); compute them and interpret them.

Course Content		
Unit	Description	Weightage* (%)
1.	Elementary concepts of Biostatistics: Definitions, Importance and Scope of Statistics; Types of Survey Methods; Importance of Data Collection & Data Collecting methods; 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; Types of Biological Data: Qualitative (Categorical) Data: Nominal and Ordinal Data Quantitative (Numerical) Data: Individual, Discrete and	

	Continuous Data; Presentation of Data: 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: Stem-and-Leaf Plots, Line Graph, Histogram, Frequency Polygon, Frequency Curve, Ogives or Cumulative Frequency Curves. Descriptive Statistics: Measures of Central Tendency: Mean or Arithmetic Mean, Median, Mode, Partition Values: Quartiles, Deciles, Percentile; Measures of Dispersion (Variation): Range, Quartile Deviation (Q.D), Inter Quartile Range (IQR), Mean Deviation (MD), Standard Deviation (SD) and Variance, Coefficient of Variation (C.V), Box and Whisker Plot. Measures of Skewness and Kurtosis: Absolute and Relative Skewness; Karl – Pearson's Coeff. of Skewness, Bowley's Coeff. of Skewness, Skewness based on moments; Moments, Kurtosis.	
2.	Correlation and Regression Analysis: Correlation: Meaning, Applications & 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 and Application of Regression Analysis and Regression Coefficients;	
3.	Concepts of Probability and Probability Distributions: Elements of Probability theory; Classical definition of Probability; Types of Experiments and Events; Theorems/Laws of Probabilities; Conditional Probability; Bayes' Theorem; Importance and Properties of Probability Distributions: Binomial Distribution, Poisson Distribution, Normal Distribution. Testing of Hypothesis: Procedure of testing hypothesis; Standard Error and Sampling distribution;	
4.	Different tests of Significance: 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); Chi (χ^2) test and Goodness of fit; F-test and Analysis of Variance (ANOVA): Techniques of Analysis of Variance; One–Way Classification, Two–Way Classification model;	

Teaching-Learning Methodology	Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Course materials will be provided from primary and secondary sources of information.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Develop the ability to apply the methods while working on a research project work.
2.	Describe the appropriate statistical methods required for a particular research design.
3.	Choose the appropriate research design and develop appropriate research hypothesis for a research project.
4.	Develop an appropriate framework for biological research studies.

Suggested References:

Sr. No.	References
1.	Gupta S.C. and Kapoor V.K. (1986): Fundamental of Mathematical Statistics Sultan Chand and Sons Publishers, New Delhi/
2.	Gupta, S. C., (2012). Statistical Methods. Sultan Chand & Sons publishers, New Delhi
3.	Pagano, M., Gauvreau, K., (2018). Principles of Biostatistics Chapman and Hall/CRC publisher, United States
4.	Daniel, W., W., (2012). Biostatistics: A Foundation for Analysis in the Health Sciences. 7th Edn. Wiley India Publications, Mumbai

On-line resources to be used if available as reference material
On-line Resources
Relevant review articles/research papers/handouts of latest development in the subject