Syllabus: Data, descriptive statistics, and visualization: Introduction to different types of data in biology; Descriptive statistics like mean, median, mode, quartiles, standard deviation, standard error; Different types of plots like scatter plot, bar graph, line graph, pie chart, box plot, frequency histogram; Understanding error bars. Probability and probability distributions: basic concepts of probability, conditional probability, Bayes theorem; binomial, multinomial, Poisson, exponential, and Gaussian distribution; Sampling distribution and central limit theorem. Hypothesis testing: Student's t-test, Z-test, Chi-squared test, ANOVA. Correlation, regression and estimation: Pearson correlation; Regression: linear, non-linear, single and multivariate; concept of likelihood and method of maximum likelihood. Tools for data of high throughput experiments: principle component analysis; Clustering of data: K-means algorithm, hierarchical clustering; Visualization tools: heat map, volcano plot. Laboratory component: R and MS Excel based exercises on graphical visualization of data, different tests of hypothesis, estimation of correlation, regression, PCA, clustering.

Texts:
1. S. Ross, *A First Course in Probability*, 9th Edition, Pearson Education India, 2014.
2. R. C. Elston and W. D. Johnson, *Basic Biostatistics for Geneticists and Epidemiologists: A Practical Approach*, 1st Edition, Wiley, 2008.
3. G. Hartvigsen, *A Primer in Biological Data Analysis and Visualization Using R*, 1st Edition, Columbia University Press, 2014.

References:
1. M. C. Whitlock, and D. Schluter, *The Analysis of Biological Data*, 2nd Edition, W. H. Freeman & Company, 2014.
2. G. P. Quinn, and M. J. Keough, *Experimental Design and Data Analysis for Biologists*, 1st Edition, Cambridge University Press, 2002.
3. M. D. Ugarte, A. F. Militino, and A. T. Arnholt, *Probability and Statistics with R*, 2nd Edition, CRC Press, 2016.