

**Department of Botany, University of Jammu, Jammu**  
**Ph.D. Botany 2023**

**RESEARCH TECHNIQUES, BIOSTATISTICS AND BIOINFORMATICS**

**Course No. Ph.D./Bot/2023/01A**

**Max. Marks: 100**  
**Time: 3 hours**

**UNIT-I: ANALYTICAL RESEARCH TECHNIQUES**

- 1.1 Principles and applications of microscopy (phase contrast, fluorescence, SEM, TEM).
- 1.2 Concept and applications of spectrophotometry: colorimetry, visible and UV-Vis spectrophotometry.
- 1.3 Principles and applications of column and gas chromatography (HPLC, HPTLC, UFLC, GC).
- 1.4 Concept and applications of spectroscopy (NMR, ESR, AAS, Plasma emission spectroscopy, GC-MS, LC-MS).

**UNIT-II: MOLECULAR TECHNIQUES**

- 2.1 Methods of DNA and RNA isolation (CTAB and Trizol method).
- 2.2 Principles and applications of electrophoresis- AGE, PAGE, OFAGE, PFGE
- 2.3 Genome editing: ODM, ZFN, TALEN, CRISPER-Cas.
- 2.4 Methods of cDNA synthesis, preparation of cDNA libraries, concept and applications of next genome sequencing (NGS).

**UNIT-III BIO-STATISTICAL METHODS-I**

- 3.1 Form, method and applications of probability distributions, Binomial, Poisson and Normal Distributions.
- 3.2 Tests of hypothesis and two types of errors; Parametric and non- parametric tests- concept and differences.
- 3.3 Methods of computation and applications of parametric tests (paired and unpaired t-tests, F- and Z- tests).
- 3.4 Principles of designs of experiments – CRD and RBD; their role in manufacturing and service processes; ANOVA- one way, two -way and repeated measures, Pearson coefficient analysis.

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## UNIT- IV BIO-STATISTICAL METHODS-II

- 4.1 Simple regression and correlation; Regression lines, coefficient of determination and correlation coefficient, confidence intervals.
- 4.2 Multiple regression- concept, calculations and relationships among individual variables; Partial F-test and correlations, Stepwise regression- concept and types.
- 4.3 Logistic regression- concept, computation and maximum likelihood procedures, goodness of fit and overall tests of significance.
- 4.4 Analysis of covariance: concept, assumptions, methods and applications; non- linear regression.

## UNIT-V BIOINFORMATICS

- 5.1 Bioinformatics: concept and applications, primer designing for PCR, q-RT-PCR.
- 5.2 Gene regulatory network: creation of GRN and its applications.
- 5.3 Protein databases: Japanese and European databanks, their application in plant research.
- 5.4 String databases: it usage and applications for finding protein-protein interactions.

## SUGGESTED READINGS

1. Khan IA and Khanum A. (2018). Fundamentals of Biostatistics. 5th revision. Ukaaz publications, Hyderabad.
2. Sokal RR and Rohlf FJ (2001). Biometry-The Principles and Practice of Statistics in Biological Research. W. H. Freeman and Company, New York.
3. Datta AK (2006) Basic Biostatistics and its Applications. New Central Book Agency (P) Ltd., Kolkata, India.
4. Gupta SP (2019). Statistical Methods. Sultan Chand, New Delhi.
5. Krebs JE, Goldstein ES and Kilpatrick ST (2018). Lewin's Genes XII. Cengage publishers, Burlington.
6. Hu P, Hegde M and Lennon PA (2012). Modern Clinical Molecular Techniques. United Kingdom: Springer New York.
7. Mullertz A, Rades T and Perrie Y (2016). Analytical Techniques in the Pharmaceutical Sciences. United States: Springer New York.
8. Rastogi SC and Mendiratta N (2018). Bioinformatics: Concepts, Skills & Applications: CBS Publishers & Distributors, India.
9. Shaik NA, Hakeem KR and Banaganapalli B (2019). Essentials of Bioinformatics, Volume I: Understanding Bioinformatics: Genes to proteins, Springer International Publishing.

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