**DEPARTMENT OF BIOTECHNOLGY**
**GOVT. DEGREE COLLEGE BARAMULLA**

**SEMESTER 5th (NEP)** **MAJOR/MINOR COURSE**

## SUBJECT: BIOTECHNOLOGY

## TITLE: ELEMENTARY BIOSTATISTICS AND BIOINFORMATICS

- CREDIT: (4+2) THEORY: 04; PRACTICAL: 02 CONTACT HOURS: 64 (T) + 64 (L)
- **Course Learning Objective:** *This course introduces students to basic statistical concepts involved in biology and illustrates the power of computing in modern biology.*

- **Expected Learning Outcomes:** *At the end of the course students should be able to:*
  - *collect, analyse and interpret data.*
  - *establish the relationship between different statistical data variables.*
  - *use basic bioinformatics tools for understanding biological data and prediction of different structures.*

### Unit – 1 (16 HOURS)

Sample, Population, sampling techniques (Random and Non-random). Data collection and its representation (Histogram, Bar Chart, Pie chart, Frequency curve). Measures of Central Tendency (Mean, Median, Mode and their comparison). Measures of Dispersion (Mean deviation, standard deviation and variance, coefficient of variance).

### Unit – 2 (16 HOURS)

Sampling distribution. Confidence intervals. Test of significance: standard error of mean, p-value & statistical significance, students' 't' test, paired test. Chi square test. F-test and analysis of variance (null hypothesis, analysis of variance 'ANOVA').

### Unit – 3 (16 HOURS)

Basic concept of Bioinformatics and its significance, Introduction to Biological databases for DNA and Protein Sequences-Nucleic Acid Sequence Databases (NCBI, GenBank, EMBL and DDBJ). Brief Overview of Structure and Nucleotide Sequence Analysis Tools- Programs to Predict Complete Gene Structure (GENSCAN, GRAIL, BCM Gene Finder), Programs to predict Promoter Elements (MatInspector and FASTM)

### Unit – 4 (16 HOURS)

Protein Sequence Databases (PIR, Swiss-PROT, PDB, TrEMBL and Prosite). Structural Databases (PDB, SCOP and CATH). Sequence Alignment- Pairwise alignment technique,

Multiple Sequence Alignment : Tools for Sequence Alignment-BLAST and its Variants. Microarray Database (GEO).

**PRACTICALS (2 CREDITS: 64 hours) Maximum Marks: 50, Minimum Marks: 20**

1. Collection of primary and secondary data
2. Calculation of Mean, Mode and Median in MS Excel.
3. Use of MS excel for drawing: histogram, bar-chart & piechart.
4. Online Usage of NCBI Resources.
5. Online usage of different Databases and Sequence Alignment Tool.
6. Designing of primers for a given gene.

**BOOKS RECOMMENDED**


1. Bert Gurtsman, Basic Biostatistics.
2. W.W Daniel, Biostatistics: A foundation for analysis in the Health Sciences, JohnWiley and Sons.
3. VB Rastogi, Biostatistics, Medtech
4. Kulkarni, A.P., Basics of Biostatistics, CBS Publishers & Distributors
5. Rastogi, Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery, Prentice Hall India Learning Private Limited.
6. JinXiong, Essential Bioinformatics, Cambridge University Press.
7. Ghosh, Z. and Mallick, B, Bioinformatics – Principles and Applications, Oxford University Press.

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**SEMESTER 5th (NEP)** **MAJOR COURSE**

## SUBJECT: BIOTECHNOLOGY

## TITLE: PLANT BIOTECHNOLGY

- CREDIT: (4+2) THEORY: 04; PRACTICAL: 02 CONTACT HOURS: 64 (T) + 64 (L)

- **Course Learning Objective***: The aim of this course is to impart knowledge about plant tissue culture, micropropagation and transgenic plants.*
- **Course outcomes:** *A student will be able to:*
  - *decipher the basic requirements of plant cell/tissue culture.*
  - *prepare different types of cultures for invitro propagation.*
  - *comprehend different applications of plant biotechnology.*
  - *generate transgenic plants by using different methods.*

### UNIT – 1 (16 HOURS)

Introduction - Plant tissue culture, Totipotency vs plasticity. Plant Tissue Culture Media - composition and role of its essential components with specific reference to Murashige and Skoog Medium. Plant growth regulators and their role. Steps in tissue culture: explant collection, surface sterilization, inoculation, callus induction, subculturing, regeneration and hardening of plants.

### UNIT – 2 (16 HOURS)

Meristem culture and its use in production of virus free plants. Micro propagation of plants (Medicinal and Endangered plants). Somatic embryogenesis and its importance. Artificial seeds: production, applications and limitations. Anther/ovule culture, production of androgenic haploids. Somaclonal variations, sources of somaclonal variants, applications of somaclonal variations for crop improvement. Cryopreservation.

### UNIT – 3 (16 HOURS)

Protoplast isolation (mechanical and enzymatic methods), culturing and regeneration of protoplasts, protoplast fusion (mechanical fusion, chemo fusion, electro fusion) and selection of somatic hybrids and cybrids. Somatic hybridization and its role in gene transfer. Plant transformation: Mechanism of T-DNA transfer, Concept of co-integrate and binary vectors. Direct gene transfer methods: polyethylene glycol (PEG)-mediated transformation, silicon carbide fibre method with advantages and limitations of each method.

### UNIT – 4 (16 HOURS)

Applications of plant transformation and genetic engineering for quality improvement, disease and herbicide resistant plants. Enhancement of shelf life of fruits (flavr savr) and vegetables. Molecular mechanism of GM crops with specific reference to Golden Rice and Bt cotton.

Molecular pharming: production of edible vaccines, antibodies and therapeutic proteins. Ethical and Biosafety issues related to GM crops.

**PRACTICALS (2 CREDITS: 64 hours) Maximum Marks: 50, Minimum Marks: 20**

1. Basic requirements for Plant Tissue Culture Lab.
2. Preparation of plant tissue culture media.
3. Surface sterilization protocols.
4. Explant preparation and inoculation.
5. Callus formation and induction of shoot/roots using different regimes of plant growth regulators.
6. Demonstration with regard to hardening and field transfer of Tissue culture raised plants.
7. Subject related Tour.

**BOOKS RECOMMENDED**


1. Razdan, M. K., Introduction to Plant Tissue Culture, Oxford & Ibh Publishing.
2. Chawla, H. S., Introduction to Plant Biotechnology, Oxford & Ibh Publishing.
3. Smith R., Plant Tissue Culture, Academic Press.
4. Slater, A., Scott, N. W., & Fowler, M. R., Plant Biotechnology: an Introduction to Genetic Engineering. Oxford: Oxford University Press.
5. Gregory Phillips Oluf Gamborg, Plant Cell, Tissue And Organ Culture: Fundamental Methods, Springer.