Sree Siddaganga Education Society (R.)

Estd. 1982

Sree Siddaganga College of Arts, Science and Commerce for Women

(Affiliated to Tumkur University)

Re-accredited with Grade B+

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Genetic Engineering Techniques Syllabus

Course Duration: 30 Hours

Course Objectives:

- To understand the basic principles and techniques of genetic engineering.
- To gain practical knowledge and hands-on experience in genetic manipulation.
- To learn about the applications of genetic engineering in various fields.

Course Outline:

Module 1: Introduction to Genetic Engineering (3 Hours)

1. Lecture 1: Overview of Genetic Engineering

- Definition and history
- Importance and applications

2. Lecture 2: Basic Concepts of Molecular Biology

- DNA, RNA, and proteins
- Gene structure and function

3. Lecture 3: Tools and Enzymes Used in Genetic Engineering

- Restriction enzymes, ligases, polymerases
- Vectors: plasmids, bacteriophages, cosmids, and artificial chromosomes

Module 2: Techniques in Genetic Engineering (12 Hours)

4. Lecture 4: Cloning Techniques

- Gene cloning
- Cloning vectors and hosts

5. Lecture 5: Polymerase Chain Reaction (PCR)

- Principles and types of PCR
- Applications of PCR

6. Lecture 6: Gel Electrophoresis

- Agarose and polyacrylamide gel electrophoresis
- DNA and protein separation

7. Lecture 7: DNA Sequencing

- Sanger sequencing
- Next-generation sequencing

8. Lecture 8: Genetic Transformation and Transfection

- Methods of gene transfer
- Transformation in bacteria, plants, and animals

9. Lecture 9: CRISPR-Cas9 Technology

- Mechanism and components
- Applications in gene editing

10. Lecture 10: RNA Interference and Gene Silencing

- Mechanism of RNAi
- Applications in research and therapy

11. Lecture 11: Site-Directed Mutagenesis

- Techniques and applications
- Practical examples

12. Lecture 12: Ethical, Legal, and Social Issues

- GMO regulations
- Ethical considerations in genetic engineering

Module 3: Applications of Genetic Engineering (5 Hours)

13. Lecture 13: Genetic Engineering in Medicine

- Gene therapy
- Production of recombinant proteins and vaccines

14. Lecture 14: Genetic Engineering in Agriculture

- Development of GM crops
- Pest resistance and improved nutritional content

15. Lecture 15: Industrial Applications

- Microbial biotechnology
- Biofuel production

16. Lecture 16: Environmental Applications

- Bioremediation
- Genetic engineering for conservation

17. Lecture 17: Case Studies

- Success stories and current research trends

Module 4: Practical Sessions (10 Hours)

18. Lab 1: DNA Isolation and Quantification

- Extraction of genomic DNA
- Spectrophotometric analysis

19. Lab 2: Restriction Digestion and Ligation

- Digestion of DNA with restriction enzymes
- DNA ligation techniques

20. Lab 3: PCR and Gel Electrophoresis

- Amplification of DNA by PCR
- Analysis of PCR products by gel electrophoresis

21. Lab 4: Bacterial Transformation

- Preparation of competent cells

- Transformation using plasmid DNA

22. Lab 5: CRISPR-Cas9 Gene Editing

- Design and synthesis of guide RNA

- CRISPR-mediated gene editing in bacterial cells

References:

1. Books:

- "Molecular Cloning: A Laboratory Manual" by Sambrook and Russell

- "Genomes 4" by T.A. Brown

- "Principles of Gene Manipulation and Genomics" by Sandy B. Primrose and Richard Twyman

- "Introduction to Biotechnology" by William J. Thieman and Michael A. Palladino

2. Journals and Articles:

- Relevant articles from journals like "Nature Biotechnology", "Journal of Molecular Biology", and "Genetic Engineering & Biotechnology News"

3. Online Resources:

- NCBI (National Center for Biotechnology Information)

- EMBL-EBI (European Molecular Biology Laboratory - European Bioinformatics Institute)