



# **Sri Venkateswara University, Tirupati**

**Syllabus for MICROBIOLOGY Major in consonance with Curriculum frame work  
w.e.f. AY 2026-27**

## **COURSE STRUCTURE (for Semester III)**

| Year | Semester | Course | Title of the Course                                          | No. of Hrs /Week | No. of Credits |
|------|----------|--------|--------------------------------------------------------------|------------------|----------------|
| II   | III      | 5      | Cell biology and Genetics                                    | 3                | 3              |
|      |          |        | Cell biology and Genetics-Practical                          | 2                | 1              |
|      |          | 6      | Molecular biology and bacterial Genetics                     | 3                | 3              |
|      |          |        | Molecular biology and bacterial Genetics-Practical           | 2                | 1              |
|      |          | 7      | r DNA Technology, Bioinformatics and Biostatistics           | 3                | 3              |
|      |          |        | r DNA Technology, Bioinformatics and Biostatistics-Practical | 2                | 1              |

  
Chairman Board of Studies (PG)  
MICROBIOLOGY  
S. V. UNIVERSITY  
TIRUPATI-517 502 A.P.

**B.Sc. (Microbiology)**  
**(W.E.F. AY-2026-27)**

**Major**  
**SEMESTER-III**

**COURSE 7: r-DNA TECHNOLOGY, BIOINFORMATICS AND BIOSTATISTICS**

**Theory**

**Credits: 3**

**3 hrs/week**

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**I. Learning Objectives:**

1. To learn principles, tools, and vectors used in gene cloning.
2. To understand blotting, DNA sequencing, PCR, and RFLP techniques.
3. To impart knowledge about gene libraries, recombinant DNA applications, and intellectual property rights.
4. To explore bioinformatic databases, tools, sequence alignment, and ChIP.
5. To understand measures of central tendency, dispersion, and data presentation.

**II. Course Outcomes: On completion of this course, students will be able to:**

1. Explain the fundamental principles and tools of genetic engineering, including gene cloning steps, vectors, and DNA transformation methods.
2. Outline genomic techniques and explain major applications of recombinant DNA technology in various fields.
3. Describe key genetic engineering techniques and recognize the importance of intellectual property rights in biotechnology.
4. Utilize major bioinformatics databases and tools for sequence retrieval, alignment, and analysis.
5. Apply basic biostatistical methods for data analysis and effectively use statistical software for biological data interpretation.

**III. Syllabus of Theory:**

**UNIT- 1: Gene cloning- Tools and techniques**

**9 Hrs.**

- 1.1 Steps in gene cloning.
- 1.2 Cloning tools: Restriction endonucleases Type II, DNA polymerases, ligases, Exonucleases, DNase, polynucleotide kinase, alkaline phosphatase; Use of linkers and adaptors.
- 1.3 Cloning Vectors: Plasmid (PBR 322), Bacteriophages, Cosmid, BAC, YAC, Expression vector- *E. coli* promoter-based vector.
- 1.4 Brief account on the transformation of DNA (Chemical method, Electroporation).

**UNIT- 2: Techniques in genetic engineering**

**9 Hrs.**

- 2.1 Blotting Techniques: Southern, Northern, and Western blotting techniques
- 2.2 DNA Sequencing-Sanger's method
- 2.3 Basics of Polymerase Chain Reaction; RFLP.

**UNIT- 3: Gene libraries, Applications of r-DNA technology, and IPR**

**9 Hrs.**

- 3.1 Genomic and c-DNA Libraries: Preparation and uses
- 3.2 Application of genetic engineering in industry, agriculture, and medicine, Hybridoma Technology.

### 3.3 Outlines of Intellectual Property Rights: Patents, Trademarks, Copyright.

#### **UNIT- 4: Bioinformatics**

**9 Hrs**

- 4.1. Bioinformatic resources: NCBI, EMBL, DDBJ, PUBMED, BIOMED.
- 4.2 Sequence Databases – GENBANK, BLAST, FASTA, ExPasy, PDB, NDB, UNIPROT – SWISS PROT.
- 4.3 Sequence alignment – Sequence homology, pairwise sequence alignment, automated DNA sequencing, ChIP.

#### **UNIT- 5: Biostatistics**

**9 Hrs**

- 5.1 Measurement of central tendency: Mean, Median, Mode.
- 5.2 Measurement of dispersion: Standard Deviation, Standard error, t-test and Chi square test
- 5.3 Sample and population: Types of Data, methods of Data presentation.
- 5.4 Use of Biostatistics software: IBM- SPSS or Minitab

#### **IV. Co-curricular activities:**

- 1. Create a model or poster showing cloning steps and vectors.
- 2. Demonstrate PCR or virtual blotting techniques in a workshop.
- 3. Prepare a chart/poster on r-DNA applications and IPR concepts.
- 4. Hands-on session using BLAST or GenBank for sequence analysis.

#### **V. Reference Books:**

- 1. Brown, T. A. (2010). *Gene Cloning and DNA Analysis* (6th ed.). Blackwell Publishing, Oxford, UK.
- 2. Campbell, A. M., & Heyer, L. J. (2006). *Discovering Genomics, Proteomics and Bioinformatics* (2nd ed.). Benjamin Cummings.
- 3. Clark, D. P., & Pazdernik, N. J. (2009). *Biotechnology: Applying the Genetic Revolution*. Elsevier Academic Press, USA.
- 4. Ghosh, Z., & Bibekand, M. (2008). *Bioinformatics: Principles and Applications*. Oxford University Press.
- 5. Glick, B. R., Pasternak, J. J., & Patten, C. L. (2010). *Molecular Biotechnology* (4th ed.). ASM Press.
- 6. Gupta, P. K. (2009). *Elements of Biotechnology* (2nd ed.). Rastogi Publications.
- 7. Pevsner, J. (2009). *Bioinformatics and Functional Genomics* (2nd ed.). Wiley-Blackwell.
- 8. Primrose, S. B., & Twyman, R. M. (2008). *Genomics: Applications in Human Biology*. Blackwell Publishing, Oxford, UK.
- 9. Ratledge, C., & Kristiansen, B. (2001). *Basic Biotechnology* (2nd ed.). Cambridge University Press.
- 10. Sambrook, J., & Russell, D. (2001). *Molecular Cloning: A Laboratory Manual* (3rd ed.). Cold Spring Harbor Laboratory Press.
- 11. Swartz, J. R. (2001). Advances in Escherichia coli production of therapeutic proteins. *Current Opinion in Biotechnology*, 12, 195–201.

**SEMESTER-III**  
**COURSE 7: r-DNA TECHNOLOGY, BIOINFORMATICS AND BIostatISTICS**  
**Practical                      Credits: 1                      2 hrs/week**

**I. Course Outcomes:** On successful completion of this practical course, the student shall be able to:

1. Isolate, digest, ligate, and amplify DNA using standard molecular biology techniques.
2. Analyze DNA fragments, interpret sequencing data, and perform RFLP analysis.
3. Retrieve and align sequences using bioinformatics tools like BLAST and Clustal W.

**II. Laboratory/Field exercises:**

1. Isolation of plasmid DNA by Agarose gel Electrophoresis.
2. Digestion of DNA using restriction enzymes and analysis by agarose gel electrophoresis.
3. Ligation of DNA fragments by using T4 DNA Ligase.
4. Amplification of DNA by PCR
5. Demonstrate RFLP
6. Interpretation of sequencing gel electropherograms.
7. Introduction to bioinformatics databases: NCBI, EMBL
8. Sequence retrieval using BLAST.
9. Sequence alignment using Clustal W.

**4- Year UG Honours, Major  
Syllabus  
(2026-27)  
Semester-III**

**Model Question Paper**

**Time : 3hrs**

**Marks:75**

**Part-A**

**Answer any Five Questions. Each Question carries 3 Marks.**

**5x3=15**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

**Answer the following questions. Each question carries 12 Marks**

**5x12=60**

11. a) Unit-I  
(Or)  
b) Unit-I

12. a) Unit-II  
(Or)  
b) Unit-II

13. a) Unit-III  
(Or)  
b) Unit-III

14. a) Unit-IV  
(Or)  
b) Unit-IV

15. a) Unit-V  
(Or)  
b) Unit-V