



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.



SRI VENKATESWARA UNIVERSITY, TIRUPATHI

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

Major

SEMESTER-III

COURSE 5: CELL BIOLOGY AND GENETICS

Theory

Credits: 3

3 hrs/week

I. Learning Objectives:

1. Explain cell theory, organelles, the cell cycle, and cytoskeleton functions.
2. Describe the cell membrane, nuclear envelope, nucleolus, and the basics of cancer development.
3. Illustrate protein sorting, signal transduction, apoptosis, and specialized chromosomes.
4. Apply Mendelian genetics, including crosses, inheritance patterns, and allele frequencies.
5. Understand linkage, crossing over, the Hardy-Weinberg law, natural selection, genetic drift, and sex determination.

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

1. Distinguish prokaryotic and eukaryotic cell structures, describe major cell organelles and cytoskeletal elements, and explain the regulation of the cell cycle and mitosis.
2. Understand membrane structure and transport, nuclear organization, and basic concepts of cancer.
3. Learn about cell signaling, protein transport mechanisms, and the regulation of apoptosis.
4. Gain knowledge of Mendelian inheritance and its extensions, including specialized chromosomes, pedigree analysis, multiple alleles, and epistasis.
5. Describe linkage and crossing over, apply population genetics principles, and differentiate modes of sex-linked and extranuclear inheritance.

III. Syllabus of Theory:

Unit 1

09 Hrs

- 1.1 Cell theory and cell organelles (Mitochondria, Chloroplasts, Lysosomes, Glyoxysomes, and Peroxisomes, Golgi apparatus, and ER).
- 1.2 Prokaryotic cells, eukaryotic cells
- 1.3 Cell cycle and its checkpoints. Mitosis and meiosis
- 1.4 Cytoskeleton: Structure and organization. Role of actin, myosin, and intermediate filaments, microtubules.

Unit 2

09 Hrs

- 2.1 Structure and functions: Cell membrane, proton pumps ($\text{Na}^+\text{-K}^+$ pump, Ca^{2+} -) and their distribution.
- 2.2 Endocytosis: Phagocytosis, Pinocytosis, Exocytosis.
- 2.3 Nuclear envelope: Structure of nuclear pore complex, nuclear lamina, Nucleolus; Transport across nuclear membrane.
- 2.4 Elementary knowledge of cancer development and causes; Oncogenes and suppressor genes,

Unit 3**09 Hrs**

- 3.1 Basic structure of cell signaling systems; first messengers and intracellular secondary messengers.
- 3.2 Cell-to-cell signaling: Eukaryotes-endocrine hormone signaling, cytokine signaling; prokaryotes-quorum sensing, bacterial pheromones.
- 3.3 Protein sorting and Transport; Intracellular signal transduction pathways (GPCR, ERK Pathway)
- 3.4 Apoptosis: Programmed Cell Death; Brief note on Stem cells

UNIT 4**09 Hrs**

- 4.1 Mendelian Genetics: Mendel's Laws (Laws of dominance, segregation, and Independent assortment.
- 4.2 Deviations from Mendel's laws: Incomplete dominance, co-dominance, epistasis.
- 4.3 Chromosome theory of inheritance: Multiple alleles, lethal alleles

Unit – 5**09 Hrs**

- 5.1 Linkage and Crossing over; Theories of linkage; Significance of Linkage.
Crossing over: Types of crossing over and the mechanism of crossing over. Difference between linkage and crossing over.
- 5.2 Sex determination; Sex linked inheritance;
- 5.3 Theory of Evolution: Natural selection; Genetic drift.

IV. Co-curricular activities:

- 1. Prepare 3D models of cell organelles and demonstrate their functions.
- 2. Observe mitosis, cell structures, and apoptosis using prepared slides.
- 3. Solve monohybrid and dihybrid problems.
- 4. Use interactive software or games to explore linkage, crossing over, and sex-linked inheritance.

V. Reference Books:

- 1. A.J.F Griffiths, S. R Wessler, S. B Carroll & J. Doebley, An Introduction to Genetic Analysis. 10th Ed., W.H. Freeman & Company (New York) 2010
- 2. Geoffrey M. Cooper and Robert E. Hausman - The Cell: A Molecular Approach.
- 3. Bruce Alberts, Rebecca Heald, et al. Molecular Biology Of The Cell
- 4. Arnold Berk (Author), Chris A. Kaiser (Author), Harvey Lodish (Author), Angelika Amon (Author), Molecular Cell Biology.
- 5. Benjamin Lewin Genes
- 6. Eldon John Gardner, Michael J. Simmons, D. Peter Snustad Principles of Genetics
- 7. Karp G, John Wiley Cell Biology
- 8. Jane B. Reece (Author), Martha R. Taylor (Author), Eric J. Simon (Author), Jean L. Dickey , Campbell Biology: Concepts and Connections
- 9. Veer Bala Rastogi, Genetics B D Singh, Genetics

SEMESTER-III
COURSE 5: CELL BIOLOGY AND GENETICS

Practical Credits: 1 2 hrs/week

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

1. Observe and analyze cell structure, organelles, and cell viability.
2. Examine mitosis, meiosis, and identify cancer cells using microscopy.
3. Apply genetic principles to study linkage, recombination, and gene mapping.

II. Laboratory/Field exercises:

1. Yeast cell counting and Viability
2. Study the plant organelle (Chlorella) and the animal cell (Amoeba) by microscopy.
3. Study of the ultrastructure of the cell (Plasma membrane, Nucleus, Nuclear Pore Complex, Chloroplast, Mitochondrion, Golgi bodies, SER, and RER)
4. Demonstration of the presence of mitochondria in striated muscle cells/ cheek epithelial cells using the vital stain Janus Green B
5. Observe the Mitosis from onion root tips.
6. Observe Meiosis of flower buds.
7. Identification and study of cancer cells by photomicrographs
8. Study of linkage and recombination using marker-based data from *Drosophila*.

**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