



SRI VENKATESWARA UNIVERSITY, TIRUPATHI

4 -Year UG Honours in B.Sc. BOTANY: Major in Consonance with Curriculum Frame work w.e.f AY 2026-27

IV Semester

COURSE STRUCTURE (for Semester IV)

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	IV	8	Cell and Molecular biology	3	3
			Cell and Molecular biology -Practical	2	1
		9	Genetics and Plant breeding	3	3
			Genetics and Plant breeding -Practical	2	1
		10	Plant Physiology and Metabolism	3	3
			Plant Physiology and Metabolism -Practical	2	1

Signatures of the Board of Studies members

Sl No.	Designation	Name	Signature
1	BOS Chairman	Dr Mohano Behera, Department of Botany, Govt. Degree College, Pakala	
2	Member	Dr L. Md. Bakshu, Department of Botany, Dr YSR Govt. Degree College, Vedula Kuppam	
3	Member	Dr M. Hemalatha, Department of Botany, SVCR Govt. Degree College, Palamaner	
4	Member	Dr A. Sasikala, Department of Botany, SVCR Govt. Degree College, Palamaner	
5	Member	Smt. S. Padmavathi, Department of Botany, Govt. Degree College, Puttur	
6	Member	Dr P. Sujana, Department of Botany, Govt. Degree College, Puttur	


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S.V. UNIVERSITY
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COURSE 9: GENETICS AND PLANT BREEDING

Theory

Credits: 3

3 hrs/week

I. Learning Objectives: By the end of this course the learner has:

1. To look into the ultra-structure of plant cell and its organelle
2. To know the morphology and functions of chromosomes
3. To understand the principles of genetics, structure and functions of gene

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

1. Sketch the ultra-structural aspects of plant cell and its components.
2. Hypothesize the role of chromosomes in inheritance.
3. Justify the role of genes in inheritance of characters by descent.
4. Correlate the functions of the nucleic acid with their structure.
5. Explain the discoveries led to understand the fine structure of a gene.

III. Syllabus of Theory:

Unit-1: Mendelian and non-Mendelian Genetics

10 Hrs.

1. Introduction, Scope of Genetics, Mendel's laws of inheritance- Law of Dominance, Law of segregation, and Law of independent assortment, Test cross and back cross.
2. Incomplete dominance and co-dominance; Multiple allelism.
3. Complementary, supplementary and duplicate gene interactions (plant-based examples are to be dealt).
4. Gene and alleles: Classical, and modern concepts of gene, structure of a gene

Unit-2: Linkage and crossing over

9 Hrs.

1. Chromosomal basis for Inheritance, Linkage: Coupling phase and repulsive phase, chromosomal theory of linkage and kinds of linkage
2. Crossing over: Mechanism of crossing over, Significance, theories of crossing over, tetrad analysis
3. Construction of chromosomal maps: 2 point and 3 point test cross.

Unit-3: Mutations

9 Hrs.

1. Mutation: Types of mutations, mutagens. Gene mutations and types.
2. Chromosomal aberrations-variation in chromosomal number and structure. Polyploidy and its significance,
3. Transposons: types, structure and mechanism of transposition and its significance

Unit-4: Basic concepts of plant breeding

8 Hrs.

1. Definition, aim, objectives and scope of plant breeding; concepts in plant breeding: genetic variation, heritability, and selection
2. Self-incompatibility in plants – Definition, heteromorphic and homomorphic systems; exploitation of self-incompatibility in hybrid production.
3. Male sterility- Genetic, cytoplasmic and cytoplasmic-genetic sterility, utilization in plant breeding.



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Unit-5: Breeding methods in plants

9 Hrs.

1. Plant introduction-objectives plant introduction agencies in India, procedure, merits and demerits
2. Selection-natural and artificial selection; pureline, clonal and mass selection, advantages, disadvantages and achievements
3. Hybridization-objectives, procedure, advantages, disadvantages and achievements and Heterosis and its significance.
4. Mutational breeding –method, advantages, limitations and achievements
5. DNA markers and their applications in plant breeding: RFLP, RAPD

IV. Text Books:

1. Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., & Doebley, J. (2020). Introduction to Genetic Analysis (12th ed.). W. H. Freeman and Company.
2. Snustad, D. P., & Simmons, M. J. (2019). Principles of Genetics (7th ed.). Wiley.
3. Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2022). Concepts of Genetics (12th ed.). Pearson Education.
4. Acquaah, G. (2021). Principles of Plant Genetics and Breeding (3rd ed.). Wiley-Blackwell.
5. Singh, B. D. (2020). Plant Breeding: Principles and Methods (11th ed.). Kalyani Publishers.
6. Allard, R. W. (1999). Principles of Plant Breeding (2nd ed.). Wiley.

V. Reference Books:

1. Hartl, D. L., & Ruvolo, M. (2020). Genetics: Analysis of Genes and Genomes (9th ed.). Jones & Bartlett Learning.
2. Strickberger, M. W. (2012). Genetics (3rd ed.). PHI Learning Pvt. Ltd.
3. Gardner, E. J., Simmons, M. J., & Snustad, D. P. (2006). Principles of Genetics (8th ed.). Wiley India Pvt. Ltd.
4. Chaudhari, H. K. (2022). Elementary Principles of Plant Breeding (Oxford & IBH).
5. Sharma, J. R. (2015). Principles and Practice of Plant Breeding. Tata McGraw-Hill Education.
6. Jain, H. K., & Kharkwal, M. C. (Eds.). (2004). Plant Breeding: Mendelian to Molecular Approaches. Narosa Publishing House.

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Solving the problems on classical genetics.

Evaluation method: Assessing the accuracy in solving the problems and awarding a grade.

Unit-2: Activity: Construction of chromosomal maps

Evaluation method: Selecting the best and assigning a grade.

Unit-3: Activity: Hands on activity of making models for chromosomal aberrations

Evaluation method: Selecting the best and assigning a grade.

Unit-4: Activity: Field trip to an agriculture or a horticulture research station to learn hybridization techniques.

Evaluation method: Active participation and learning skills on production of hybrid plants. **Unit-5: Activity:** Case studies of modern applications of molecular techniques in crop improvement.

Evaluation method: Based on a rubric with specified criteria and performance levels of the learner.



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COURSE 9: GENETICS AND PLANT BREEDING

Practical

Credits: 1

2 hrs/week

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

1. Apply Mendelian principles to solve genetic problems and analyze segregation and independent assortment using monohybrid and dihybrid crosses.
2. Conduct experiments to determine linkage, recombination, and gene mapping using test cross and three-point test cross data.
3. Perform emasculation and artificial hybridization techniques in self-pollinated and cross-pollinated crops.

II. Laboratory/field exercises:

1. Solving problems on monohybrid, dihybrid, back and test crosses.
2. Solving problems on gene interactions (at least one problem for each of the gene interactions in the syllabus).
3. Chromosomes mapping using problems of 3- point test cross data.
4. Floral biology in a self and a cross-pollinated plant species.
5. Practicing emasculation technique.
6. Practicing selfing and crossing techniques.


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COURSE 9: GENETICS AND PLANT BREEDING

Suggested Model Paper for Practical Examination

Max Time: 3 Hrs

Max. Marks: 50

1. Solve the given Genetic problem and write the conclusions. 'A' 15 M
2. Explain the process of plant hybridization in the perspective of plant breeding 'B' 15 M
4. Identify and comment on the given specimens/spotters/slides/photographs 4 x 3=12 M
- C. Genetics
- D. Genetics
- E. Plant breeding
- F. Plant breeding
5. Record & Viva- voce 5 + 3 = 08 M


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

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