



**University of Kerala**

|                |  |                  |                   |                    |                  |
|----------------|--|------------------|-------------------|--------------------|------------------|
| Discipline     | <b>BOTANY</b>  |                  |                   |                    |                  |
| Course Code    | <b>UK5DSCBOT302</b>  |                  |                   |                    |                  |
| Course Title   | <b>PLANT GENETICS</b>  |                  |                   |                    |                  |
| Type of Course | <b>DSC</b>   |                  |                   |                    |                  |
| Semester       | <b>V</b>   |                  |                   |                    |                  |
| Academic Level | <b>300 – 399</b>   |                  |                   |                    |                  |
| Course Details | Credit   | Lecture per week | Tutorial per week | Practical per week | Total Hours/Week |
|                | 04   | 4 Hours          | -                 |                    | 4 Hours          |
| Pre-requisites | Students have a knowledge about cytology which is the basic objective of genetics  |                  |                   |                    |                  |
| Course Summary | Course offers a comprehensive knowledge about the characters and its inheritance. The students gain the knowledge of history of genetics and its advancements. |                  |                   |                    |                  |

**Detailed Syllabus:**

| Module    | Unit                             | Content  | Hrs       |
|-----------|----------------------------------|--|-----------|
| <b>I</b>  | <b>Heredity and Variation</b>    |  | <b>10</b> |
|           | 1                                | Definition, Mendelian genetics-An account of Mendelian experiments and selection of characters, Reason behind Mendel's success, Monohybrid and Dihybrid crosses, Back cross- test cross, Mendelian ratios, Mendelian principles and laws- Principle of unit characters, Principle of dominance, Law of segregation and Law of independent assortment.<br><b>Learning Activity:-</b> Work out the problems related with monohybrid and dihybrid crosses and Test crosses.   |           |
| <b>II</b> | <b>Modified Mendelian ratios</b> |  | <b>15</b> |
|           | 2                                | Incomplete Dominance- Flower colour in <i>Mirabilis jalapa</i> ; co-dominance- MN blood group in man; gene interactions (non-allelic interactions)- Complementary gene action- flower colour in <i>Lathyrus odoratus</i> ; Epistasis- dominant (fruit colour in <i>Cucurbita pepo</i> ) and recessive (coat colour in mice); Collaboratory gene action- comb patterns in domestic fowls; Duplicate gene action- seed shape in <i>Capsella bursa pastoris</i> ; Duplicate gene with cumulative effect- fruit shape in <i>Cucurbita pepo</i> , Inhibitory gene action- leaf colour in <i>Oryza sativa</i> .<br><b>Learning Activity:-</b> Work out the problems related with different allelic and non-allelic interactions. |           |
|           | 3                                | Multiple allelism- ABO blood group in man, self-sterility in <i>Nicotiana tobacco</i> ; Rh factor.   |           |

|            |  |   |           |
|------------|--|---|-----------|
|            | 4  | Quantitative characters- General characteristics, polygenic inheritance- Skin colour in man, ear size in <i>Zea mays</i> .  |           |
| <b>III</b> | <b>Role of chromosomes</b>   |   | <b>10</b> |
|            | 5  | Chromosome theory of inheritance; Coupling and repulsion; Linkage- significance and types (complete and incomplete); Cis and trans heterozygote; Morgan's theory of linkage; crossing over- mechanism, types and significance. Interference and coincidence, Crossover value; Gene mapping; two point and three point test crosses.<br><b>Learning Activity:-</b> Work out the problems related with two point and three point test crosses |           |
| <b>IV</b>  | <b>Sex determination and inheritance patterns</b>                      |   | <b>10</b> |
|            | 6  | Sex determination in organisms- Chromosome basis of sex determination (XX-XY, XX-XO types), sex determination in higher plants- <i>Melandrium album</i> ; Genic balance theory.   |           |
|            | 7  | Sex linked inheritance- X linked (Haemophilia and eye colour in <i>Drosophila</i> ), Y linked (Hypertrichosis pinnae) and XY linked (Bobbed bristles in <i>Drosophila</i> )   |           |
|            | 8  | Extra chromosomal inheritance- Maternal effect, Plastid inheritance in <i>Mirabilis jalapa</i> , inheritance of kappa particles in <i>Paramecium</i> .  |           |
| <b>V</b>   | <b>Applying genetics: Analysis, disorders, and population genetics</b> |   | <b>15</b> |
|            | 9  | Karyotype and Pedigree analysis; Inborn errors of metabolism- alkaptonuria, phenylketonuria and albinism; Syndromes- Klinefelter's syndrome, Turner's syndrome and Down syndrome.<br>Population genetics- systems of mating and their genetic effect; Hardy Weinberg law and its applications; threatening of gene frequency- migration, mutation, genetic drift, genetic polymorphism and selection.                                       |           |

### Suggested Reading

1. Snustad, P.D and Simmons, M.J. (2012) Principles of genetics VI<sup>th</sup> Edn. John Wiley and Sons, Inc.
2. William, S. Klug. Michael, R. Cummings. Charlotte, A. Spencer and Michael, A. Palladino. (2012) Concepts of genetics. Pearson Education, Inc.
3. Gardner. Simmons, M.J and Snustad, P.D. (2006) Principles of Genetics, John Willey and Sons.
4. Strickberger, M.W. (1985) Genetics. Mac Millan India, New Delhi.
5. Goodenough, U. (1984) Genetics. Holt Saunders, New York.
6. Gupta, P.K. (2022) Genetics. Rastogi publications, ISBN: 9788193775707
7. Robert J Brooker. Concepts of Genetics. ISBN13:9781260709629
8. Verma, P.S and Agarwal, V.K. (2005) Cell biology, genetics, molecular biology, evolution and ecology. Chand Publocations.

## Weblink

1. <https://learn.genetics.utah.edu/content/basics/>
2. <https://education.nationalgeographic.org/resource/resource-library-cell-biology>

## Course Outcomes

| No.  | Upon completion of the course the graduate will be able to  | Cognitive Level | PSO addressed |
|------|---|-----------------|---------------|
| CO-1 | Students Recognize and understand the basic concepts of genetics, Mendelian experiments and conclusions.              | R, U            | PSO-2         |
| CO-2 | Learn about the various allelic and non-allelic interactions.   | R, U            |               |
| CO-3 | Compare the qualitative and quantitative characters and their Inheritance.  | U, An, E        |               |
| CO-4 | Develop skills in students to integrate the heredity and variation with chromosomes.                                  | U, An,          | PSO-4         |
| CO-5 | Learn about the sex determination in organisms, inheritance of Body characters through sex chromosomes and cytoplasm. | R, U, An        |               |

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

**Name of the Course: Plant Genetics**

**Credits: 4:0:0 (Lecture:Tutorial:Practical)**

| CO No. | CO | PO/PSO | Cognitive Level | Knowledge Category | Lecture (L)/Tutorial (T) | Practical (P) |
|--------|----|--------|-----------------|--------------------|--------------------------|---------------|
| 1      | 1  | 2      | R, U            | F, C               | L,T                      |               |
| 2      | 2  |        | R, U            | F, C               | L,T                      |               |
| 3      | 3  |        | U, An, E        | F, C               | L,T                      |               |
| 4      | 4  | 4      | U, An,          | F, C               | L,T                      |               |
| 5      | 5  |        | R, U, An        | C, P               | L                        | P             |

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

**Mapping of COs to Assessment Rubrics :**

|      | <b>Internal Exam</b> | <b>Assignment</b> | <b>Project Evaluation</b> | <b>End Semester Examinations</b> |
|------|----------------------|-------------------|---------------------------|----------------------------------|
| CO 1 | ✓                    | ✓                 |                           | ✓                                |
| CO 2 | ✓                    | ✓                 |                           | ✓                                |
| CO 3 |                      | ✓                 | ✓                         | ✓                                |
| CO 4 | ✓                    | ✓                 |                           | ✓                                |
| CO 5 |                      | ✓                 | ✓                         | ✓                                |