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| **B.Sc.** | **Semester - IV** | **Credits: 4** |
| **Course: 5** | **Cell Biology, Genetics and Plant Breeding** | **Hrs/Wk: 4** |

**Learning outcomes:** On successful completion of this course,the students will be able to:

* Distinguish prokaryotic and eukaryotic cells and design the model of a cell.
* Explain the organization of a eukaryotic chromosomeand the structure of genetic material.
* Demonstrate techniques to observe the cell and its componentsunder a microscope.
* Discuss the basics of Mendelian genetics, its variations and interpret inheritance of traits in living beings.
* Elucidate the role of extra-chromosomal genetic material for inheritance of characters.
* Evaluate the structure, function and regulation of genetic material.
* Understand the application of principles and modern techniques inplant breeding.
* Explain the procedures of selection and hybridization for improvement of crops.

**UNIT I: The Cell 12 Hrs.**

1. Cell theory; prokaryotic vs eukaryotic cell; animal vs plant cell; a brief account on ultra- structure of a plant cell.
2. Ultra-structure of cell wall.
3. Ultra-structure of plasma membrane and various theories on its organization.
4. Polymorphic cell organelles (Plastids); ultrastructure of chloroplast. Plastid DNA.

**UNIT II: Chromosomes 12 Hrs.**

1. Prokaryotic vs eukaryotic chromosome. Morphology of a eukayotic chromosome.
2. Euchromatin and Heterochromatin; Karyotype and ideogram.
3. Brief account of chromosomal aberrations - structural and numerical changes
4. Organization of DNA in a chromosome (solenoid and nucleosome models).

**UNIT III: Mendelian and Non-Mendelian genetics 14Hrs.**

1. Mendel’s laws of inheritance. Incomplete dominance and co-dominance; Multiple allelism.
2. Complementary, supplementary and duplicate gene interactions (plant based examples are to be dealt).
3. A brief account of linkage and crossing over; Chromosomal mapping - 2 point and 3 point test cross.
4. Concept of maternal inheritance (Corren’s experiment on *Mirabilis jalapa*); Mitochondrial DNA.

## UNIT IV: Structure and functions of DNA 12 Hrs.

1. Watson and Crick model of DNA. Brief account on DNA Replication (Semi- conservative method).
2. Brief account on Transcription, types and functions of RNA. Gene concept and genetic code and Translation.
3. Regulation of gene expression in prokaryotes - Lac Operon.

## UNIT V: Plant Breeding 12 Hrs.

1. Plant Breeding and its scope; Genetic basis for plant breeding. Plant Introduction and acclimatization.
2. Definition, procedure; applications and uses; advantages and limitations of :(a) Mass selection,

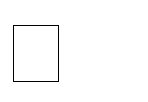
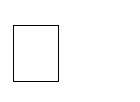
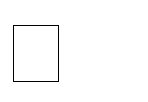
(b) Pure line selection and (c) Clonal selection.

1. Hybridization – schemes, and technique; Heterosis(hybrid vigour).
2. brief account on Molecular breeding – DNA markers in plant breeding. RAPD, RFLP.

## TEXT BOOKS :

1. Botany – III (Vrukshasastram-I) : Telugu Akademi, Hyderabad
2. Pandey, B.P. (2013) *College Botany, Volume-III,* S. Chand Publishing, New Delhi
3. Ghosh, A.K., K.Bhattacharya&G. Hait (2011) *A Text Book of Botany, Volume-III,* New Central Book Agency Pvt. Ltd., Kolkata
4. Chaudhary, R. C. (1996) *Introduction to Plant Breeding,* Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi

## REFERENCE BOOKS:

1. S. C. Rastogi (2008)*Cell Biology,*New Age International (P) Ltd. Publishers, New Delhi
2. P. K. Gupta (2002)*Cell and Molecular biology,*Rastogi Publications, New Delhi
3. B. D. Singh (2008) *Genetics,*Kalyani Publishers, Ludhiana
4. A.V.S.S. Sambamurty (2007) *Molecular Genetics,*Narosa Publishing House,New Delhi
5. Cooper, G.M. & R.E. Hausman (2009)*The Cell – A Molecular Approach,* A.S.M. Press, Washington
6. Becker, W.M., L.J. Kleinsmith& J. Hardin (2007)*The World of Cell,* Pearson Education, Inc., New York
7. De Robertis, E.D.P. & E.M.F. De Robertis Jr. (2002)*Cell and Molecular Biology,* Lippincott Williams & Wilkins Publ., Philadelphia
8. Robert H. Tamarin (2002)*Principles of Genetics,*Tata McGraw –Hill Publishing Company Limited, New Delhi.
9. Gardner, E.J., M. J. Simmons & D.P. Snustad (2004)*Principles of Genetics,* John Wiley & Sons Inc., New York
10. Micklos, D.A., G.A. Freyer& D.A. Cotty (2005) *DNA Science: A First Course,* I.K. International Pvt. Ltd., New Delhi
11. Chaudhari, H.K.(1983)*Elementary Principles of Plant Breeding*, TMHpublishers Co., New Delhi
12. Sharma, J.R. (1994)*Principles and Practice of Plant Breeding*, Tata McGraw- Hill Publishers, New Delhi
13. Singh,B.D. (2001)*Plant Breeding : Principles and Methods ,*Kalyani Publishers, Ludhiana
14. Pundhan Singh (2015) *Plant Breeding for Undergraduate Students,* Kalyani Publishers, Ludhiana
15. upta, S.K. (2010)*Plant Breeding : Theory and Techniques,*Agrobios (India), Jodhpur
16. Hayes, H.K., F.R. Immer& D.C. Smith (2009) *Methods of Plant Breeding,* Biotech Books, Delhi

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| **B.Sc.** | **Semester - IV** | **Credits: 1** |
| **Course: 5(L)** | **Cell Biology, Genetics and Plant Breeding Lab** | **Hrs/Wk: 2** |

**Course Outcomes:** After successful completion of this practical course the student shall be able to:

* Show the understanding of techniques of demonstrating Mitosis and Meiosis in the laboratory and identify differentstages of cell division.
* Identify and explain with diagram the cellular parts of a cell from a model or picture and prepare models
* Solve the problems related to crosses and gene interactions.
* Demonstrate plant breeding techniques such as emasculation and bagging

**Practical Syllabus:**

1. Study of ultra structure of plant cell and its organelles using Electron microscopic Photographs

/models.

1. Demonstration of Mitosis in *Allium cepa*/*Aloe vera* roots using squashtechnique; observation of various stages of mitosis in permanent slides.
2. Demonstration of Meiosis in P.M.C.s of *Allium cepa*flower buds using squash technique; observation of various stages of meiosis in permanent slides.
3. Study of structure of DNA and RNA molecules using models.
4. Solving problems monohybrid, hybrid, back and test crosses.
5. Solving problems on gene interactions (atleast one problem for each of the gene interactions in the syllabus)
6. Chromosome mapping using 3- point test cross data.
7. Demonstration of emasculation, bagging, artificial pollination techniques for hybridization.

**Model paper for Practical Examination**

Semester-IV / Botany Core Course – 5

**Cell Biology, Genetics and Plant Breeding**

Max. Time : 3 Hrs. Max. Marks : 50

1. Make a cytological preparation of given material ‘A’ (mitosis or meiosis in Onion) by squash technique, report any two stages, draw labeled diagrams and write the reasons. 15 M
2. Solve the given Genetic problem (Dihybrid cross/ Interaction of genes/ 3-point test cross) ‘B’ and write the conclusions. 15 M
3. Identify the following and justify with apt reasons. 3 x 4 = 12 M
4. Cell Biology (Cell organelle)
5. Genetics (DNA/RNA)
6. Plant Breeding
7. Record + Viva-voce 5 + 3 = 8 M

**Suggested co-curricular activities for Botany Core Course- 5 in Semester-IV :**

1. **Measurable :**
   1. **Student seminars :**
      1. Light microscopy : bright field and dark field microscopy.
      2. Scanning Electron Microscopy (SEM).
      3. Transmission Electron Microscopy (TEM).
      4. Mitosis and Meiosis
      5. Cell cycle and its regulation.
      6. Cell organelles bounded by single membrane.
      7. Prokaryotic chromosomes
      8. Special types of chromosomes :Polytene, Lampbrush and B-chromosomes.
      9. Different forms of DNA.
      10. Gene mutations.
      11. DNA damage and repair mechanisms.
      12. Reverse transcription.
      13. Protein structure.
      14. Modes of reproduction in plants.
      15. Modes of pollination in plants
   2. **Student Study Projects :**
      1. Study of mitoticcell cycle in roots of*Aliumcepa*
      2. tudy of mitoticcell cycle in roots of*Aloe vera*
      3. Observation of chromosomal aberrations in *Allium cepa* root cells exposed toindustrial effluent(s).
      4. Observation of chromosomal aberrations in *Allium cepa* root cells exposed toheavy metal(s).
      5. Observation of polyembryony in *Citrus* spp.and *Mangiferaindica.*
   3. **Assignments**: Written assignment at home / during ‘0’ hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.
2. **General :**

* Field visit to Agriculture/Horticulture University/ Research station to observe Plant breeding methods.
* Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

**RECOMMENDED ASSESSMENT OF STUDENTS:**

**Recommended continuous assessment methods for all courses:**

Some of the following suggested assessment methodologies could be adopted. Formal assessment for awarding marks for Internal Assessment in theory.

1. **Formal:**
2. The oral and written examinations (Scheduled and surprise tests),
3. Simple, medium and Critical Assignments and Problem-solving exercises,
4. Practical assignments and laboratory reports,
5. Assessment of practical skills,
6. Individual and group project reports,
7. Seminar presentations,
8. Viva voce interviews.
9. **Informal:**
10. Computerized adaptive testing, literature surveys and evaluations,
11. Peers and self-assessment, outputs form individual and collaborative work
12. Closed-book and open-book tests,

## MODEL QUESTION COURSE (Sem-End)

**B. Sc DEGREE EXAMINATION**

**SEMESTER: IV**

**Course 5: Cell Biology, Genetics and Plant Breeding**

**Time: 3Hrs. Max. Marks: 75**

## SECTION - A

**Answer any FIVE questions. Each question carries 5 marks 5 x 5 =25M**

* 1. Differences between prokaryotic and eukaryotic cells.
  2. (a) Karyotype (b) Ideogram
  3. (a) Incomplete dominance (b) Co-dominance
  4. Maternal inheritance
  5. Double helical structure of DNA
  6. Genetic code
  7. Objectives and scope of plant breeding
  8. Plant introduction

## SECTION - B

**Answer ALL the questions. Each question carries 10 marks 5X10 =50M**

* 1. a) Describe the ultrastructure of cell wall.

(OR)

b) Write an essay on plastid DNA with a well labeled diagram.

* 1. a) Discuss the structure of a eukaryotic chromosome with a neat labeled diagram.

(OR)

b) Explain the organization of DNA in chromosomes with suitable theories.

11.a) Discuss complementary and duplicate gene interactions with suitable examples.

(OR)

b) Explain mapping of genes with the help of 3-point test cross.

12. a) Describe the semi-conservative mode of DNA replication.

(OR)

b) Define an operon. Explain the regulation of Lac-operon.

13.a) Write an essay on procedure; applications and uses; advantages and limitations mass selection.

(OR)

b) Give an account of utilization of RFLP and RAPD in molecular plant breeding.