Bot-205 Cell Biology, Genetics and Evolution Credit Hours: 4 (3+1)

THEORY:

Introduction of the Course:

This course is planned to provide adequate knowledge about morphology and functioning of cell, cellular organelles and mechanisms of cell division, study of genes and their inheritance patterns and concept of evolution. It is generally aimed to familiarize students with the cell structure and its functioning along with basic concepts of genetics.

Course Objectives:

The course is designed:

1. To provide an adequate knowledge about basic concepts of different parts of cells and their morphological/anatomical characteristics along with their functions.
2. To provide basics of Genetics and Evolution.

Contents:

1. Cell Biology:

1.1. Structures and brief description of biomolecules, carbohydrates, lipids, proteins, nucleic acids.

1.2. Cell: Physico-chemical nature of plasma membrane and cytoplasm.

1.3. Ultrastructure of plant cell with a brief description and functions of the following organelles: Endoplasmic reticulum, Plastids, Mitochondria, Ribosomes, Dictyosomes, Vacuole, Microbodies (Glyoxysomes and Peroxisomes)

1.4 Nucleus: Nuclear membrane, nucleolus, ultrastructure and morphology of chromosomes, karyotype analysis;

1.5. Reproduction in somatic and embryogenic cell; Mitosis and meiosis; Cell cycle;

1.6. Chromosomal aberrations; Changes in the number of chromosomes, aneuploidy and euploidy; Changes in the structure of chromosomes, deletion, duplication, inversion and translocation, special types of chromosomes, Chromosome systems (parthenogenesis and apomixis).

2. Genetics and Evolution:

2.1. Introduction, scope and brief history of genetics.

2.2. Mendelian inheritance; Laws of segregation and independent assortment, back cross, test cross; Dominance and incomplete dominance.

2.3. Sex linked inheritance, Sex Linkage in *Drosophila* and Man (Color blindness), XO, XY, WZ mechanisms, Sex limited and sex linked characters, Sex determination.

2.4. Linkage and crossing over; Linkage groups, Construction of linkage maps, Detection of linkage.

2.5. Recombination; DNA replication; Nature of gene, Genetic code; Transcription, Translation.

2.6. Regulation of gene expression (*e.g. lac* operon).

2.7. Transmission of genetic material in bacteria; conjugation and gene recombination in co-transduction and transformation;

2.8. Principles of genetic engineering, basic genetic engineering techniques;

2.9. The process and concept of evolution, theories of origin in life, historic idea of evolution, sources of variability, different mechanisms of gene change, role of gene mutation in evolution.

Practicals:

Cell Biology

1. Study of cell structure using compound microscope.
2. Elucidation of ultrastructure of cell from electron microphotographs.
3. Measurement of cell size.
4. Study of mitosis and meiosis by smear/squash method and from prepared slides.

5. Study of chromosome morphology.
6. Study of variation in chromosome number.
7. Extraction and estimation of carbohydrates.
8. Extraction and estimation of proteins.
9. Extraction and estimation of RNA and DNA from plant material.

Genetics

1. Genetic problems related to transmission and distribution of genetic material
2. Identification of DNA in plant material (carmine/ orcein staining)
3. Study of salivary gland chromosomes of Drosophila.

Teaching-learning Strategies

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop
5. Problems practice to clear genetics concepts

Learning Outcomes:

1. Students are expected to get familiarized with the morphological and anatomical concepts about different cell parts.

2. They will be able to describe, apply and integrate the basic concepts of Cell Biology including Genetics and Evolution, Biochemistry, Physiology as well as Structure and Functions of different Organelles.

3. This will enable them qualify for basic to moderate level jobs involving general knowledge of Biology.

4. The obtained knowledge shall also enable the students to enter into various entrepreneurial activities involving general introduction to botany.

Assessment Strategies:

1. Lecture Based Examination (Objective and Subjective)
2. Assignments
3. Class discussion
4. Quiz
5. Tests

Recommended Readings:

1. Bretscher, A. (2007). *Molecular Cell Biology*. W. H. Freeman and Company
2. Carroll, S. B., Grenier, J. K. and Velnerbee S. D. (2001). From DNA to Diversity—Molecular Genetics and the Evolution of Aminal Design. Blackwell Science.
3. Dyonsager, V. R. (2000). *Cytology and Genetics*. (3rd Ed.), TATA and McGraw Hill Publication Co. Ltd, New Delhi.
4. Gilmartin, P. M. and Bowler, C. (2002). *Molecular Plant Biology*. (Vol. 1 & 2). Oxford University Press. UK.
5. Griffiths, J. F., Miller, J. H., Suzuki, D. T., Lewontin, R. C. and W. M. Gelbart (2010). *An Introduction to Genetic Analysis*. W.H. Freeman and Company.
6. Hoelzel, A. R. (2001). *Conservation Genetics*. Kluwer Academic Publishers.
7. Karp, G. (2002). *Cell and Molecular Biology*. Concepts and Experiments. (4th Ed.), John Wiley and Sons. New York.
8. Lodish, H. (2001). *Molecular Cell Biology*. W.H. Freeman and Company.
9. Sinha, U. and Sinha S. (2003). *Cytogenesis, Plant Breeding and Evolution.* Vini Educational Books, New Delhi.
10. Strickberger, M. V. (2003). *Genetics*. MacMillan Press Ltd., London.
11. Weaver, R. F. (2008). *Molecular Biology*. McGraw Hill, St. Louis.

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