Bot-401 & 402 PRINCIPLES OF GENETICS Credit Hours: 3(2+1)

THEORY:

Introduction of the Course:

This course includes concepts regarding inheritance patterns, recombination in bacteria, linkage and mapping, extranuclear inheritance, developmental and population genetics.

Course Objectives:

1. To enable the students to understand the structural and functional basis of genes and proteins and their mutual interactions
2. To enable the students to understand various DNA manipulations at the molecular level

Contents:

1. **Study of Inheritance Patterns:** Mendel's laws of inheritance**,** extensions of mendelian analysis, dominant and recessive alleles, multiple alleles, lethal alleles, several genes affecting the same character, penetrance and expressivity, quantitative inheritance.
2. **Linkage and Mapping**: Basic eukaryotic chromosome mapping. The discovery of linkage, recombination, linkage symbolism, linkage of genes on the X chromosome, linkage maps, three-point testcross, interference, linkage mapping by recombination in humans, accurate calculation of large map distances, mapping human chromosomes.
3. **Gene Mutation**: Somatic versus germinal mutation, mutant types, the occurrence of mutations, mutation and cancer, mutagens and genetic disorders, evolutionary significance of mutation.
4. **Recombination in Bacteria and Viruses**: Bacterial chromosome, bacterial conjugation, bacterial recombination, bacterial transformation, transduction, mapping of bacterial chromosomes, bacteriophage genetics, bacterial gene transfer.
5. **The Structure of DNA**: DNA-The genetic material, DNA replication in eukaryotes.
6. **The Nature of the Gene**: How genes work, gene- protein relationships, genetic fine structure, complementation.
7. **DNA Function**: Transcription, translation, the genetic code, protein synthesis.
8. **The Extranuclear Genome**: Variegation in leaves of higher plants, cytoplasmic inheritance in fungi, extranuclear genes in *Chlamydomonas*, mitochrondrial genes in yeast, extragenomic plasmids in eukaryotes.

9. **Developmental Genetics**: Gene regulation and differentiation, Crown gall disease in plants, proto-oncogenes and oncogenes, cancer as a developmental genetic disease.
10. **Population Genetics**: Gene frequencies, conservation of gene frequencies, equilibrium, Hardy-Weinberg law, factors affecting gene equilibrium.

Practicals:

Numerical problems with reference to:

- Arrangement of genetic material
- Linkage and recombination
- Gene mapping in diploids
- Recombination in Fungi
- Recombination in bacteria
- Recombination in viruses.
- Population Genetics: Gene frequencies and equilibrium, Changes in gene frequencies,
- Blood group and Rh-factor.
- Drosophila: Culture technique, Salivary gland chromosome
- Fungal genetics: Sacchromyces culture techniques and study.
- Studies on variation in maize ear size and colour variation.
- Bacterial Genetics. Bacterial cultural techniques, Gram staining (*E. coli*, *B. subtilis*), Transformation, Conjugation.

Recommended Readings:

1. S. B. Gelvin. (2000). *Plant Molecular Biology Manual*. Kluwer Academic Publishers.
2. B. A. Pierca. (2005) *Genetics*. A conceptual approach, W. H. Freeman and Company, New York.
3. L. Synder and W. Champness. (2004) *Molecular Genetics of Bacteria*. ASM Press, Washington D.C.
4. W. S. Klug and M. R. Cummings (1997) *Concepts of Genetics*, Prentice Hall International Inc.
5. N. V. Roth Well (1997) *UnderstandingGenetics*, second edition, Oxford University Press Inc.
6. E. J. Gardner (2004) *PrinciplesofGenetics*, John Willey and Sons, New York.
7. J. Ringo (2004) *FundamentalGenetics*, Cambridge University Press.
8. A. J. F. Griffiths, S. R. Wessler, R. C. Lewontin, W. M. Gelbart, D. T. Suzuki, and J. H. Miller (2010) *IntroductiontoGeneticAnalysis*, W.H. Freeman and Company. 11thed.
9. L. Snyder and W. Champness (2003) *MolecularGeneticsofBacteria*, ASM Press.
10. D. L. Hartl, and E. W. Jones (2005) *Genetics -AnalysisofGenesandGenomes*, Jones and Bartlett Publishers. Sudbary, USA.
11. P. W. Hedrick (2005) *GeneticsofPopulation*. Jones and Bartlett Publisher, Sudbury, USA.

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