MST303: GENETICS	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Prerequisite: - MST103, MST153 Molecular Biology, MST102, Cell and development biology, MST105 Computer application and statistics.

Course Objectives:

1. To understand the basic of bacterial mutation which includetheir types, gene transfer from one to another etc.
2. To learn about the association of gene in the genome and how they are expressed in other parts of genome like transposable elements or jumping genes.
3. To learn and have complete knowledge of type of plasmids and their important in genetics and recombinant DNA technology.
4. To understand how Mendelian Genetics plays important role in understand the concept, by the virtue of different laws that he proposed.
5. To learn the basic terminology and concept of cytogenetics, bow cell divide? How information transfer from one to another etc .
6. To expertise themselves in understanding the concepts of evolution and how population genetics works.

Detailed Syllabus

Unit-1

Bacterial mutants and mutations Isolation; Useful phenotypes (auxotrophic, conditional, lethal, resistant); Mutation rate; Types of mutations(base pair changes; frameshift; insertions; deletions; tandem duplication); Reversion vs. suppression; Mutagenic agents; Mechanisms of mutagenesis; Assay of mutagenic agents (Ames test) Gene transfer in bacteria History; Transduction – generalized and specialized; Conjugation – F, F', Hfr; F transfer; Hfr-mediated chromosome transfer; Transformation – natural and artificial transformation; Merodiploid generation; Gene mapping; Transposable genetic elements; Insertion sequences; Composite and Complex transposons; Replicative and non-replicative transposition; Genetic analysis using transposons.

Unit-2

Bacteriophages and Plasmids Bacteriophage–structure; Assay; Lambda phage – genetic map, lysogenic and lytic cycles; Gene regulation; Filamentous phages such as M13; Plasmids – natural plasmids; their properties and phenotypes; Plasmid biology - copy number and its control; Incompatibility; Plasmid survival strategies; Antibiotic resistance markers on plasmids (mechanism of action and resistance); Genetic analysis using phage and plasmid ***Restriction-modification systems*** History; Types of systems and their characteristics; Methylation-dependent restriction systems; applications.

Unit-3

Mendelian Genetics Introduction to human genetics; Background and history; Types of genetic diseases; Role of genetics in medicine; Human pedigrees; Patterns of single gene inheritance-autosomal recessive; Autosomal dominant; X linked inheritance; Complicating factors - incomplete penetrance; variable expression; Multiple alleles; Co dominance; Sex influenced expression; Hemoglobinopathies - Genetic disorders of hemoglobin and their diseases. ***Non Mendelian inheritance patterns*** Mitochondrial inheritance; Genomic imprinting; Lyon hypothesis; isodisomy; Complex inheritance-genetic. Heritability; Twin studies; Behavioral traits; Analysis of quantitative and qualitative traits

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Unit-4 ***Cytogenetics*** Cell division and errors in cell division; Non disjunction; Structural and numerical chromosomal abnormalities – deletion; duplication; translocation; Sex determination; Role of Y chromosome; Genetic recombination; Disorders of sex chromosomes and autosomes; Molecular cytogenetics – Fluorescence In Situ Hybridization (FISH); Comparative Genomic Hybridization (CGH). ***Developmental genetics*** Genes in early development; Maternal effect genes; Pattern formation genes; Homeotic genes; Signaling and adhesion molecules. ***Immunogenetics*** Major histocompatibility complex; Immunoglobulin genes - tissue antigen and organ transplantation; Single gene disorders of immune system.
Unit-5 ***Genetic variation*** Mutations; kinds of mutation; agents of mutation; genome polymorphism; uses of polymorphism. ***Gene mapping and human genome project*** Physical mapping; linkage and association ***Population genetics and evolution*** Phenotype; Genotype; Gene frequency; Hardy Weinberg law; Factors distinguishing Hardy Weinberg equilibrium; Mutation selection; Migration; Gene flow; Genetic drift; Human genetic diversity; Origin of major human groups.
Text and Reference Books 1. S.R. Maloy, J.E. Cronan, D. Friefelder, Microbial Genetics, 2nd Edition, Jones and Bartlett Publishers, 1994. 2. N. Trun and J. Trempy, Fundamental Bacterial Genetics, Blackwell publishing, 2004. 3. Strachan T and Read A P, Human molecular genetics, 3rd Edition Wiley Bios, 2006. 4. Mange E J and Mange A. P., Human genetics, 2nd Edition, Sinauer Associates publications, 1999.

Course Outcomes:
After completing the course, students will be able to:

1. Understand basics of genetics by experiencing the experimentation used by Mendal.
2. Analyze the bacterial transformation and gene transfer.
3. Understand the importance of mutation and how the mutation can be fruitful for the human kind.
4. Understand the principle of cytogenetics and learn different kind of genetic disorders.
5. Will learn how gene function can be judged, importance of human genome project.
6. Will analyze and learn to determine the changes in genes in population genetics .

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