**MSc GENETICS COURSE STRUCTURE**
**CHOICE – BASED CREDIT SYSTEM**
**DEPARTMENT OF GENETICS, OSMANIA UNIVERSITY**
**(Proposed for academic year 2019 onwards)**

**MSc GENETICS I YEAR**
**SEMESTER – I**

| S. No | Syllabus Ref. No | Papers | Credits | Teaching Hours/ week | Marks | | |
|---|---|---|---|---|---|---|---|
| | | | | | Internal Assessment | Semester Exam | Total |
| 1. | G101T | Principles of Inheritance | 4 | 4 | 20 | 80 | 100 |
| 2. | G102T | Cell Biology &Cytogenetics | 4 | 4 | 20 | 80 | 100 |
| 3. | G103T | Fundamentals ofBiochemistry | 4 | 4 | 20 | 80 | 100 |
| 4. | G104T | Biostatistics and Population Genetics | 4 | 4 | 20 | 80 | 100 |
| **PRACTICALS** | | | | | | | |
| 1. | G151P | Principles of Inheritance | 2 | 4 | | 50 | 50 |
| 2. | G152P | Cell Biology &Cytogenetics | 2 | 4 | | 50 | 50 |
| 3. | G153P | Fundamentals of Biochemistry | 2 | 4 | | 50 | 50 |
| 4. | G154P | Biostatistics and Population Genetics | 2 | 4 | | 50 | 50 |
| | | **Total** | **24** | **32** | | | **600** |

**MSc GENETICS I YEAR**
**SEMESTER- I**
**THEORY PAPER- I**
**G101T: PRINCIPLES OF INHERITANCE**

## 1. Course Objectives (C.Obj)

a. To understand the molecular basis of Mendelian Inheritance in plants, animals and man
b. To acquaint the need of various model organisms used in genetic analysis
c. To comprehend the sex determination mechanisms, sex linked inheritance and patterns of Non-Mendelian inheritance
d. To analyze the linkage and mapping of genes in eukaryotic systems

## 2. Course Outcomes (C.O)

a. Student is able to comprehend and apply the Mendelian inheritance in humans, plants and animals
b. Student gains the use and handling of model organisms in research studies
c. Student relates the patterns of sex-linked, sex determination and Non-Mendelian inheritance in humans, plants and animals
d. Student is able to solve and analyze the linkage analysis of genes in eukaryotic organisms

**Course Plan/Schedule**

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 1** | **Mendelian Inheritance** | |
| 1.1 | Mendel's Laws of Inheritance- Monohybrid cross, principle of segregation, dihybrid cross, principle of independent assortment, trihybrid cross, cellular and molecular basis of Mendelian inheritance, Probability in prediction and analysis of genetic data, evaluating the fit of observed results to theoretical expectations (chi-square method) | 3 |
| 1.2 | Pedigree analysis - Segregation in human pedigrees, autosomal inheritance in humans, pedigree analysis of autosomal disorders, probability in pedigree analysis | 2 |
| 1.3 | Extensions to Mendelian Inheritance (Allelic Interactions)- codominance, incomplete dominance, pleotropism, lethals and sublethals, multiple alleles, (white eye locus in Drosophila, ABO blood group alleles in human, Rh factor alleles in man, self-incompatibility alleles in plants), segregation distortion | 3 |
| 1.4 | Extensions to Mendelian Inheritance (Non-allelic Interactions)- Epistasis, mechanism of epistasis – complementary genes, supplementary genes, recessive and dominant epistatic genes, inhibitory genes, duplicate genes, polymeric genes | 3 |
| 1.5 | Polygenic Inheritance- transgressive segregation, kernel color in wheat, skin color in man, height in man, human eye color, multifactor hypothesis, gene effects (additive, dominance, over-dominance and epistasis) - QTL | 3 |
| 1.6 | Genes to phenotype- Inborn errors of metabolism, one-gene one-enzyme hypothesis, complementation, position effect variegation(eye color in Drosophila) | 2 |

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 2** | **Eukaryotic Model Systems for Genetic Analysis** | |
| 2.1 | Life cycle and importance of Drosophila- Drosophila genome, polytene chromosomes, balancer chromosomes, morphs, fly resources | 3 |
| 2.2 | Life cycle and importance of Neurospora, sexual cycle, genome features | 2 |
| 2.3 | Life cycle and importance of Yeast, Genome features, scope and limitations as model organism | 2 |
| 2.4 | Life cycle and importance of *C.elegans*- genetics, growth and maintenance, sexual forms and their importance, genome and resources | 2 |
| 2.5 | Life cycle and importance of Zebra fish, useful features of zebra fish, zebra fish as model system for human diseases | 2 |
| 2.6 | Life cycle and importance of Arabidopsis –reasons for adoption, genome, genetic resources | 2 |
| 2.7 | Life cycle and importance of Mouse- Mouse as a model for human genetic diseases | 3 |

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 3** | **Sex determination, Sex-linked Inheritance and Extra-nuclear inheritance** | |
| 3.1 | Genetic basis of sex determination in *Drosophila*, *S. alba*, Man; Environmental effects in *Bonellia*, Lizards | 2 |
| 3.2 | Sex-linked Inheritance- X and Y-linkage-red and white eye colour in *Drosophila, haemophilia* and colour blindness in man. Sex limited and sex influenced traits | 2 |
| 3.3 | Non-Mendelian Inheritance– Leaf variegation of higher plants, Corren's studies in *Mirabilis jalapa,* Maternal inheritance-Poky in*Neurospora*-Heterokaryon test, Maternal influence- shell coiling insnails Inheritance of *iojap* in *Zea mays* | 3 |
| 3.4 | Non-Mendelian Inheritance in man - hereditary diseases | 2 |
| 3.5 | Uniparental Inheritance - Extra nuclear genes in Chlamydomonas, Mutants showing uniparental inheritance, | 2 |
| 3.6 | Extra nuclear genes in Baker's Yeast Petite mutants, Genetic mapping of mitochondrial Genes in yeast | 2 |
| 3.7 | Significance of cytoplasmic inheritance - possible origins of chloroplast and mitochondrial genomes | 3 |

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 4** | **Linkage and Gene Mapping in Eukaryotes** | |
| 4.1 | Cytological basis and evidence of crossing over- Stern experiments in Drosophila, Creighton and McClintock experiment in maize | 3 |
| 4.2 | Concept of linkage –Linkage groups, phases of linkage, coupling and repulsion phase, meiotic recombination, recombination frequency and genetic distance | 3 |
| 4.3 | Construction of genetic maps In Drosophila and maize using two point and three point test crosses with emphasis on interference and coefficient of coincidence | 3 |
| 4.4 | Tetrad analysis and gene mapping in Neurospora | 2 |
| 4.5 | Gene mapping with unordered tetrads in yeast | 2 |
| 4.6 | Cytological mapping – Zeste-White locus mapping in Drosophila | 2 |

**PRACTICALS**

**G151P: PRINCIPLES OF INHERITANCE**

| S. No. | Topic to be covered |
|---|---|
| 1 | Life cycle of Drosophila, Maintenance of stocks and Identification of mutants |
| 2 | Life cycle of maize and Segregation analysis in maize cobs |
| 3 | Using Chi-square test on Mendelian ratios |
| 4 | Segregation analysis in Drosophila |
| 5 | Application of chi square test to gene interaction ratios |
| 6 | Mapping by Tetrad analysis |
| 7 | Gene mapping from three point test crosses |
| 8 | Autosomal inheritance in humans & pedigree analysis of autosomal disorders |
| 9 | Segregation in human pedigrees |
| 10 | Sex determination in maize |

**REFERENCE BOOKS**


1. An Introduction to Genetic Analysis, 7th edition Anthony JF Griffiths, Jeffrey H Miller, David T Suzuki, Richard C Lewontin, and William M Gelbart. New York: W. H.Freeman; 2000. ISBN-10: 0-7167-3520-2**.**
2. Genetics: A Conceptual Approach by Benjamin A Pierce (W.H. Freeman & Co. Ltd2014 ISBN-13: 9781464109461
3. Introduction to Genetics: A Molecular Approach T ABrown Edition:1st Garland Science Taylor & Francis Group ISBN: 9780815365099
4. Concepts of Genetics by William S. Klug, Michael R. Cummings, Charlotte A. Spencer2005 Benjamin-Cummings Publishing Company ISBN 0131918338 (ISBN13: 9780131918337)
5. Genetic Analysis: An Integrated Approach by Mark Frederick Sanders, John L. Bowman 2014 2nd edition ISBN: 0321948904/ ISBN-13: 9780321948908**.**
6. Drosophila: A Laboratory Handbook by Michael Ashburner Cold Spring Harbor Laboratory Press,U.S.; 2nd ed. edition ISBN-13:978-1936113699**.**
7. Theory and Problems of Genetics (Schaum's Outline Series) by William Stansfield McGraw-Hill Book Company.

**MSc GENETICS I YEAR**
**SEMESTER- I**
**THEORY PAPER- II**
**G102T: CELL BIOLOGY AND CYTOGENETICS**

## 1. Course Objectives (C.Obj)

a. To give an insight about the organelles and cytoskeleton of the cell
b. To provide an in-depth knowledge about the cell cycle, cell division, check points and cell death processes like apoptosis and necrosis
c. To understand structure and components of chromosome, hierarchical organization of chromatin and their modifications
d. To understand the structural and numerical chromosomal abnormalities in plants and animals

## 2. Course Outcomes (C.O)

a. The students learn the structure and functions of the organelles and cytoskeleton
b. The students learn the phases of the cell cycle, check points, mitosis & meiosis in detail and further know about the stimulus and cell death mechanisms
c. Gain an insight about chromatin organization so as to apply the knowledge for understanding epigenetics.
d. Understand the concept of chromosomal breakage, structural and numerical abnormalities in plants and animal chromosome

**Course Plan/Schedule**

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT-1** | **Organization of The Eukaryotic Cell** | |
| 1.1 | Microscopic techniques and applications: Light microscope, Phase contrast microscope, Fluorescent, Confocal microscope and Electron microscopes | 3 |
| 1.2 | Structure and function of Endoplasmic reticulum, Golgi complex, Lysosomes (autophagy), Secretory pathway | 3 |
| 1.3 | Structure and function of Mitochondria & Chloroplast | 3 |
| 1.4 | Structure and function of Peroxisomes, Vacuoles, Cell wall &Plasmodesmata | 2 |
| 1.5 | Structure and function of Cytoskeleton-Microtubules, Intermediate filaments and Microfilaments | 2 |
| 1.6 | Extracellular matrix: Cell-cell junctions (tight junctions, gap junctions, adherent junctions& desmosomes). Cell-Matrix junctions (hemidesmosomes& focal adhesions) | 3 |

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 2** | **Cell Cycle, Cell Division and Cell Death** | |
| 2.1 | Cell cycle: Phases of cell cycle - $G_1$(Restriction point), S, $G_2$, M and $G_0$ (Quiescence phase) | 1 |
| 2.2 | Cyclins&CDK's: Families of cyclins&CDK's ($G_1$, S, $G_2$ &M phase), Mechanisms of CDK's regulation (Association with cyclin, activating phosphorylation, inhibitory phosphorylation & CDK's inhibitors, APC/C& SCF) | 3 |
| 2.3 | Check points in cell cycle: $G_1$-S check point (E2F & p53), $G_2$-M check point (MPF, ATM &ATR) and mitosis check point (Spindle assembly-APC) | 3 |
| 2.4 | Cell Division: Mitosis-Overview of stages, Mitotic apparatus, distribution of microtubule organizing centers, sister chromatid separation (cohesions&condensins) and cytokinesis; Meiosis: Overview of Meiosis I & II - Stages (synaptonemal complex&chiasmata); Significance of mitosis and meiosis | 4 |
| 2.5 | Apoptosis: Morphological changes, mechanisms- extrinsic & intrinsic pathways and Significance | 3 |
| 2.6 | Necrosis: Characteristics, causes, mechanisms andmorphological patterns | 2 |

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 3** | **Chromosome structure and chromatin organization** | |
| 3.1 | Structure of chromosome: chromatids, centromere (primary, Secondary constriction/Nucleolar organizer & kinetochore), telomere and satellite; Specialized chromosomes -Polytene and Lamp brush | 2 |
| 3.2 | Components of chromatin: Euchromatin& Heterochromatin, Nucleic acids, histones & non-Histones; Classification and function-Evolutionary importance | 3 |
| 3.3 | Chromatin organization - Structure and organization of nucleosome in chromatin, solenoids, loops and scaffolds, nucleosome phasing | 4 |
| 3.4 | Chromatin remodeling: Histone Modifications-Acetylation, Methylation (lysins& arginine) phosphorylation, ubiquitinylation&SUMOylation, ADP ribosylation and deamination | 3 |
| 3.5 | Dosage compensation, X - chromosome inactivation | 2 |
| 3.6 | Studies on polytene chromosomes for cytogenetic mapping | 2 |

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 4** | **Chromosome Detection & aberrations** | |
| 4.1 | Karyotyping and its significance | 2 |
| 4.2 | Banding techniques (G, Q, T, R, etc), Insitu hybridization, FISH, SKY | 3 |
| 4.3 | Structural chromosomal abnormalities- Origin of breaks and gaps, ring chromosomes, Isochromosomes, centric fusion, centric fission, breakage fusion bridge cycle. Deletions, duplications, inversions, translocations | 3 |
| 4.4 | Numerical chromosomal abnormalities-Aneuploidy, Polyploidy. Non-Disjunction and Anaphase lag | 3 |
| 4.5 | Chromosome instability and associated syndromes (Ataxia telangiectasia, Fanconi anemia and Bloom syndrome, Xerodermapigmentosa) | 3 |
| 4.6 | Sister chromatid exchanges and its significance | 2 |

**PRACTICALS**

**G152P: CELL BIOLOGY AND CYTOGENETICS**

| S.No. | Topics to be covered |
|---|---|
| 1 | Confocal & Fluorescent microscope |
| 2 | Mitosis in somatic tissues of plants (Onion root tips) / animals (Mouse) |
| 3 | Meiosis in germinal tissues of plants (Maize/ Lilly) / animals (Grasshopper Testes) |
| 4 | Barr Body identification |
| 5 | Karyotype analysis |
| 6 | G banding |
| 7 | Sister chromatid exchanges |
| 8 | Polytene Chromosome |
| 9 | Induction of polyploidy |

**REFERENCE BOOKS**

1. The Cell: A Molecular Approach by Goeffrey Cooper and Robert Hausmann
2. Human Chromosomes Authors: Orlando J. Miller &EevaTherman 4th edition
3. Chromosome Techniques (Third Edition) Theory and Practice Author(s): Arun
4. Kumar Sharma and Archana Sharma
5. Molecular biology of the cell ($6^{th}$ edition)- Bruce Alberts
6. Cell and Molecular biology (eighth edition): De Robertis.

**MSc GENETICS I YEAR**
**SEMESTER- I**
**THEORY PAPER- III**
**G103T: FUNDAMENTALS OF BIOCHEMISTRY**

1. **Course Objectives (C.Obj)**
   a. To learn the basics of chemistry related to biomolecular functions
   b. Comprehend carbohydrate classification and metabolism
   c. To learn lipid, amino acid and nucleotide metabolism
   d. To comprehend the cell communication and signaling processes

2. **Course Outcomes (C.O)**
   a. Understanding the basics of biochemical processes
   b. Comprehension of central carbon metabolism
   c. Acquaintance with classification and metabolism of non-carbohydrate biomolecules
   d. Knowledge regarding the cell signaling processes and their importance

**Course Plan/Schedule**

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 1** | **Bioenergetics, proteins and enzymes** | |
| 1.1 | Laws of thermodynamics, Gibbs free energy, Enthalpy, Entropy | 2 |
| 1.2 | Importance of water in biological systems, pH, Henderson-Hasselbalch equation | 2 |
| 1.3 | Classification of amino acids based on physico-chemical properties; Peptide bond formation, Biologically active peptides | 3 |
| 1.4 | Proteins-primary, secondary & tertiary, Ramachandran plot; Classification of Proteins based on structure, composition & function | 3 |
| 1.5 | Catalysis, enzymes, coenzymes, cofactors, classification of enzymes, enzyme kinetics | 3 |
| 1.6 | Michaelis-Menten equation, enzyme regulation | 3 |

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 2** | **Carbohydrate metabolism** | |
| 2.1 | Carbohydrates (Classification, monosaccharides, disaccharides & polysaccharides) | 2 |
| 2.2 | Glycolysis, TCA cycle, Electron transport chain | 4 |
| 2.3 | Gluconeogenesis, Glycogenesis, Glycogenolysis, Glucuronic acid cycle | 2 |
| 2.4 | Pentose phosphate pathway, Entner-Doudoroff pathway, Cori cycle | 2 |
| 2.5 | Photosynthesis, C3 & C4 cycle | 4 |
| 2.6 | Complete overview of carbohydrate metabolism and networks | 2 |

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 3** | **Metabolism of lipids, amino acids and nucleotides** | |
| 3.1 | Lipids (Classification, fatty acids, steroids) | 2 |
| 3.2 | Catabolism of lipids, Beta-oxidation | 3 |
| 3.3 | Fatty acid biosynthesis, Prostaglandin biosynthesis, Cholesterol metabolism | 4 |
| 3.4 | Amino acid degradation, Urea cycle, biosynthesis of amino acids | 3 |
| 3.5 | Nitrogen metabolism: Nitrate and ammonium assimilation | 2 |
| 3.6 | Nucleotide biosynthesis and degradation | 2 |

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 4** | **Cell signaling** | |
| 4.1 | Overview of cell signaling | 2 |
| 4.2 | Cell communication (autocrine, endocrine and paracrine), Components of cell signaling (signal molecules, Cell surface receptors, nuclear receptors, second messengers) | 2 |
| 4.3 | G Protein Coupled Receptor Signaling pathway(Structure of GPCRs, G proteins, and GTPases) | 3 |
| 4.4 | RTK signaling pathways (Receptor tyrosine kinase families, Mechanisms of receptor activation) | 3 |
| 4.5 | Signal Transduction Through Ion Channels (Ligand-Gated Channels, Regulation of Ion Channels) | 2 |
| 4.6 | Wnt signaling pathways (Canonical and non-canonical); Notch signaling pathway, Toll-like receptor signaling, Hedgehog pathway | 4 |

**PRACTICALS**

**G153P: FUNDAMENTALS OF BIOCHEMISTRY**

| S. No. | Topic to be covered |
|---|---|
| 1. | Preparation of buffers |
| 2. | Spectroscopy and Centrifugation |
| 3. | Chromatography |
| 4. | Carbohydrate analysis |
| 5. | Amino acid analysis |
| 6. | Lipid analysis |
| 7. | Enzyme assay |
| 8. | Isolation of Proteins |
| 9. | Estimation of Proteins |

**REFERENCE BOOKS**

1. Lehninger's principles of Biochemistry (David L. Nelson and Michael M. Cox)
2. Biochemistry (Jeremy M. Berg, John L. Tymoczko, LubertStryer)
3. Biochemistry (Donald Voet and Judith G. Voet)
4. Molecular biology of the cell. New York: Garland Science [Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2002)].

**MSc GENETICS I YEAR**
**SEMESTER- I**
**THEORY PAPER- IV**
**G104T: BIOSTATISTICS AND POPULATION GENETICS**

1. **Course Objectives (C.Obj)**
   a. To learn the basics of biostatistics in designing experiments, analyzing experimental data, hypothesis testing and interpreting the results of biological data
   b. To learn the basic principles of population genetics and impact of evolutionary forces like mutation, selection and migration on genetic variation
   c. Understand the fundamental genetic principles governing variation of quantitative traits in populations, components of variance, heritability and inbreeding depression
   d. To understand the genetic diversity by different methods/ component analysis

2. **Course Outcomes (C.O)**
   a. Understand basic concepts in biostatistics for analyzing biological data
   b. Knowledge of evolutionary factors that influence the genetic structure of populations
   c. Knowledge on quantitative traits and components of variance involved
   d. Help in identifying genetic diversity based on the statistical comparisons

**Course Plan/Schedule**

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 1** | **Biostatistics** | |
| 1.1 | Sampling: Random sampling, methods of sampling and Experimental designs, Sampling bias | 1 |
| 1.2 | Descriptive analysis of data: Types of variables, Data alignment and representation, Measures of central tendency, Measures of dispersion, Skewness and Kurtosis | 3 |
| 1.3 | Probability: Concept of probability, Types of events, Laws of probability (Addition and multiplication laws), Bayes theorem and its applications | 2 |
| 1.4 | Probability distributions: Binomial, Poisson, Normal distribution | 2 |
| 1.5 | Hypothesis testing: Null and alternate hypothesis, test of significance, p-value, Type I and Type II errors, confidence intervals and confidence levels | 2 |
| 1.6 | Estimates and test statistics: Chi-square test (test for goodness of fit, homogeneity test, linkage, test of independence), Z test (for proportions and means), t- test (students t test, paired t test), ANOVA - One way and Two-way Anova (F- test) | 4 |
| 1.7 | Correlation and regression analysis | 2 |

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 2** | **Population Genetics** | |
| 2.1 | Population structure: Deme, Gene pool, Random mating population, Estimation of gene and genotype frequencies for biallelic, multiple allelic and X- linked loci | 2 |
| 2.2 | Hardy-Weinberg principle, Establishment of law for a) autosomal biallelic loci b) multiple allelic loci c) X-linked loci | 3 |
| 2.3 | Factors affecting HWE: Mutation (Fate of a mutation, recurrent and reverse mutation pressure), Selection (Fitness and selection coefficient; selection at the phenotype level; selection against recessives, dominants and heterozyotes, selection favoring heterozygotes; Joint effects of selection and mutation, | 4 |
| 2.4 | Migration, Genetic drift (Bottle neck effect and Founder effect), Effective population size, Genetic load (Mutational and segregational load) | 3 |
| 2.5 | Linkage disequilibrium | 2 |
| 2.6 | Effects of Inbreeding and assortative mating | 2 |

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 3** | **Quantitative Genetics** | |
| 3.1 | Quantitative traits –features (Population mean, average effect, breeding value, dominance deviation, interaction deviation) | 3 |
| 3.2 | Components of Phenotypic Variance: Reaction Norms, Resemblance between relatives | 3 |
| 3.3 | Genetic architecture of quantitative variance, Genotypic Values: Additivity, dominance and Epistasis, genetic covariance (Offspring and one parent, offspring and mid-parent, half sibs, full sibs) | 3 |
| 3.4 | Correlated characters, GxE effects and maternal effects | 3 |
| 3.5 | Heritability (ANOVA and Regression) | 2 |
| 3.6 | Heterosis and Inbreeding depression | 2 |

| Unit Number | Topics to be covered | No. of lectures |
|---|---|---|
| **UNIT 4** | **Genetic Distance and Phylogenetic Analysis** | |
| 4.1 | Defining genetic variation, factors causing genetic variation, - matting pattern, migration | 2 |
| 4.2 | Genetic diversity-Identifying genetic diversity, application of DNA markers | 2 |
| 4.3 | Neutral Theory- Neutral Theory and prediction for levels of polymorphism and rate of divergence, nearly neutral theory | 2 |
| 4.4 | Molecular clock hypothesis- dating divergence events with a molecular clock | 4 |
| 4.5 | Alignment of genes or proteins- phylogenetic tree construction; Methods for inferring of phylogenetic tree-distance based methods- Cluster analysis, UGPMA, NJ | 4 |
| 4.6 | Phylogenetic Principle component Analysis- Properties, Character based methods- Maximum Parsimony, Maximum Likelihood, Bayesian methods | 2 |

**PRACTICALS**

**G154P: BIOSTATISTICS AND POPULATION GENETICS**

| S.No. | Topics to be covered |
|---|---|
| 1 | Construction of bar diagram, histogram, frequency polygon, pie diagram, box plot |
| 2 | Estimation of Mean, Median, Mode, Standard deviation, Variance and standard error for grouped and ungrouped data, Problems on probability |
| 3 | Hypothesis testing using Z test and t-test |
| 4 | Calculation of correlation and regression |
| 5 | Problems on Hardy-Weinberg Equilibrium, Calculation of gene and genotype frequencies |
| 6 | Calculation of inbreeding coefficient |
| 7 | Estimation of heritability (ANOVA method) |
| 8 | NEIs Index |

**REFERENCE BOOKS**

1. Hedrick P.W. Jones & Bartlett, Genetics of Population
2. Hartl D. L. And Clark A. G., Principle of Population Genetics, Sinauer Associates
3. Danial, W. W, Biostatistics, Wiley
4. Khan &Khanum (2004), Fundamentals of Biostatistics, II Revised Edition, Ukaaz Publication
5. Bailey, N.T.J, Statistical methods in Biology, Cambridge Univ. Press
6. Falconer, D (1995) Introduction to Quantitative Genetics, 4th edition, Longman, London.
7. Stickberger, M. W (1990) Evolution, Jones and Bartlett, Boston
8. Fundamentals of Biostatistics, P HanmanthRao and K.Janardhan.
9. Population Genetics- C C Lee.