Centre for Human Genetics and Molecular Medicine  
School of Health Sciences  
Central University of Punjab, Bathinda

**Centre for Human Genetics and Molecular Medicine**

**Scheme of Programme Ph.D. Life Sciences with specialization Human Genetics**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Paper Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LSL.701</td>
<td>Research Methodology and Biostatistics</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>LSL.702</td>
<td>Bioethics, Biosafety and Good Laboratory Practices</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>HGL.703</td>
<td>Advanced Human Cytogenetics and Molecular Genetics</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>HGL.704</td>
<td>Advanced Human Genomics and Epigenetics</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>HGS.700</td>
<td>Credit Seminar</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Total Credit Sem-1</td>
<td></td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

L: Lectures,  T: Tutorial,  P: Practical,  Cr: Credit
LSL.701: Research Methodology and Biostatistics  Credit Hours:5

Course Objective: To teach students the basics of research, scientific writing, literature search and paper writing.

Unit: 1 20 Lectures
General principles of research: Meaning and importance of research, Critical thinking, Formulating hypothesis and development of research plan, Review of literature, Interpretation of results and discussion.
Technical writing: Scientific writing, Writing synopsis, Research paper, Poster preparation and Presentations and Dissertation; IPR and related issues.

Unit: 2 20 Lectures
General Statistics: Difference between parametric and non-parametric statistics, Univariate and multivariate analysis, Confidence interval, Errors, Levels of significance, Hypothesis testing.
Measures of central tendency and dispersal, Histograms, Probability distributions (Binomial, Poisson and Normal), Sampling distribution, Kurtosis and skewness

Unit: 3 25 Lectures
Comparative Statistics: Comparing means of two or more groups: Student’s t-test, Paired t-test, Mann-Whitney U-test, Wilcoxon signed-rank, One-way and two-way analysis of variance (ANOVA), Critical difference (CD), Fisher’s LSD (Least significant difference), Kruskal–Wallis one-way ANOVA by ranks, Friedman two-way ANOVA by ranks, Chi-square test

Unit: 4 25 Lectures

Suggested Readings:

LSL.702: Bioethics, Biosafety and Good Laboratory Practices Credit Hours: 4

Unit: 1 20 Lectures
Introduction and Principals of Good Lab Practice: Good laboratory practices, Biosafety for human health and environment. Biosafety issues for using cloned genes in medicine, agriculture, industry, and ecoprotection. Biological warfare, Biological containment and physical containment, CDC Biosafety levels, Biosafety in Clinical laboratories and biohazard management.

Unit: 2 20 Lectures
Bioethics and Biosafety in Molecular Biology: Gene pollution, Biological invasion, Risk and safety assessment from genetically engineered organisms, special procedures for r-DNA based products.

Unit: 3 25 Lectures
Research ethics: Ethical theories, Ethical considerations during research, data manipulations, subject consent, Animal testing. Animal rights, Perspectives and methodology, Ethical issues of the human genome project,

Unit: 4 25 Lectures
Medical and Clinical Ethics: Code of Ethics in Medical/clinical laboratories, healthcare rationing, ethical issues of xenotransplantation, Ethics involved in embryonic and adult stem cell research, Ethics in Assisted Reproductive Technologies: animal and human cloning and In-vitro fertilization, the element of Informed Consent, Ethical issues in MTP and Euthanasia.

Suggested reading:
HGL.703: Advanced Human Cytogenetics and Molecular Genetics  Credit Hours: 5

Course Objectives: With the advances in cytogenetic technology, information regarding human genomics, disease and cancer genetics, chromosome evolution and the relationship of nuclear structure to function have grown in spurts. Human Molecular Genetics is a vast field that provides understanding of the structure and function of the normal human genome. Human molecular genetics not only forms the cutting edge of biomedical research, but at the same time it has immediate application to the diagnosis of disease and has great potential for treating disease. Thus it is of major interest to all students of biological science and medicine, and to a wide range of biomedical researchers.

Unit: 1  18 Lectures
Advanced Human Cytogenetics: GTG banding and Nomenclature of human chromosomes; Structure of X and Y chromosome; X and Y Pairing and Pseudoautosomal region; Molecular mechanism of X inactivation Molecular Cytogenetics methods-FISH, CGH, SKY, Cytogenetics of Cancer.

Unit: 2  18 Lectures
Tissue culture techniques: Whole Blood Culture, Bone Marrow Culture, Amniocyte Culture, Chorionic villi culture, Skin Fibroblast culture.

Unit: 3  18 Lectures
DNA structure and Gene Regulation: DNA structure and superstructure, DNA replication initiation and termination, Chromosomal compaction and mechanism of gene regulation, Mechanism of mutation and DNA repair.

Unit: 18  25 Lectures
Techniques in Molecular Genetics: Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, Isolation of specific nucleic acid sequences, In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms, DNA sequencing methods, strategies for genome sequencing, RFLP, RAPD and AFLP techniques

Suggested reading:

HGL.704: Advanced Human Genomics and Epigenetics  Credit Hours: 5

Course Objectives: The aim of the course is to make students understand the advanced concepts of genetics and basic principles of epigenetics.

Unit: 1  18 Lectures
Recombinant DNA Technology: Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems; Expression of recombinant proteins using bacterial, animal and plant vectors; Isolation of specific nucleic acid sequences, Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors; protein sequencing methods, Detection of post translation modification of proteins; Methods for analysis of gene expression at RNA and protein level.

Unit: 2  18 Lectures
Pharmacogenomics and Overview of Human Genome Project: Concept of individual based treatment, Drug Metabolism; Genetic makeup and Drug Response; High throughput screening for drug discovery; Identification of drug targets; Pharmacogenetics and drug development, Personalized Medicine; goals of Human Genome Project, its implications on research and human society; Strategies for genome sequencing; Early, next and third generation DNA sequencing methods; Personalized medicine.

Unit: 3  18 Lectures
Introduction and molecular mechanisms of Epigenetics: Mechanisms of DNA methylation; Histone modifications; Chromosomal position effect and gene variegation; Epigenetic control of gene activity; Analysis of gene-specific DNA methylation; Methods of assessing genome-wide DNA methylation; Model organism of epigenetic: Drosophila

Unit: 3  18 Lectures
Epigenetic Epidemiology: Effects of diet and environmental agents on epigenetic processes; Impact of microbial infections on the human epigenome; Cancer epigenetic, Role of epigenetic in immune disorders; imprinting disorders in humans.

Suggested reading:

**HGS.700 Seminar**

**Credit Hours: 1**

**Course Objective:** This will help the student in developing the effective oral and writing skills to communicate scientific data and ideas and make them aware about the recent trends and developments in molecular medicine.

**Non-Credit Seminar:**

**Course Objective:** There are 03 the mandatory seminars during Ph.D. tenure as detailed below:

**Synopsis seminar:** Students will present this seminar at the time of synopsis submission and if desired by the experts the candidate may be asked to repeat the seminar after incorporating the suggested correction.

**Mid term seminar:** Students will present these seminars once every year after synopsis submission.

**Pre-submission seminar:** Students will present this seminar before submission of their thesis; The internal faculty may suggest changes so that overall quality of the work and thesis may be improved.