FACULTY OF LIFE SCIENCES

Syllabus

For

M. Sc. (HONS. SCHOOL) HUMAN GENETICS
(Under Credit Based Continuous Evaluation Grading System)

(SEMESTER: I - IV)

Examinations: 2015–16

Guru Nanak Dev University
Amritsar

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(ii) Subject to change in the syllabi at any time.
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**SCHEME OF COURSES**

**Semester-I**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>C/E/I</th>
<th>Course Title</th>
<th>L</th>
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<th>P</th>
<th>Total Credits</th>
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<tbody>
<tr>
<td>HGL-406</td>
<td>C</td>
<td>DNA Technology</td>
<td>3</td>
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<tr>
<td>HGL-422</td>
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<td>Medical Genetics</td>
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<tr>
<td>HGL-423</td>
<td>C</td>
<td>Methods of Research Design</td>
<td>3</td>
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<td>HGL-425</td>
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<td>Perspectives of Human Genome</td>
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<td>Lab Rotations in Molecular Genetics and Biochemistry</td>
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<td>Lab Rotations in Quantitative Genetics and Bioinformatics</td>
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**Elective Course (3 Credits)**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>C/E/I</th>
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<tr>
<td>HGP-432</td>
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<td>Lab Rotations in Molecular Genetics and Biochemistry</td>
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**Interdisciplinary/Optional Course (3 or 4 Credits)**

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<th>Course No.</th>
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<th>Course Title</th>
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<th>T</th>
<th>P</th>
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**Total Credits**

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1. The students are required to opt for one ‘Elective’ paper.
2. The students are also required to take one paper (Interdisciplinary/Optional) of 3 or 4 credits of their choice from any other department of Guru Nanak Dev University Campus, Amritsar.
### SCHEME OF COURSES

#### Semester-II

<table>
<thead>
<tr>
<th>Course No.</th>
<th>C/E/I</th>
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<tr>
<td><strong>Core Courses (22 Credits)</strong></td>
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<tr>
<td>HGL-471</td>
<td>C</td>
<td>Human Molecular Genetics and Functional Genomics</td>
<td>3</td>
<td>1</td>
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<tr>
<td>HGL-472</td>
<td>C</td>
<td>Clinical Genetics and Genetic Counselling</td>
<td>3</td>
<td>1</td>
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<td>HGL-473</td>
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<td>Bioethics and Human Genetics</td>
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<td>HGL-474</td>
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<td>Recent Concepts in Human Genetics</td>
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<td>Genetics of Human Cancer</td>
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<td>HGL-482</td>
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<td>Tools and Techniques in Immunology</td>
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<td><strong>Interdisciplinary/Optional Course (3 or 4 Credits)</strong></td>
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<td>–</td>
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<td>To be taken from outside the department</td>
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</table>

**Total Credits** 18 4 6 28

1. The students are required to opt for one ‘Elective’ paper.
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### SCHEME OF COURSES

#### Semester-III

<table>
<thead>
<tr>
<th>Course No.</th>
<th>C/E/I</th>
<th>Course Title</th>
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<tr>
<td>HGL-505</td>
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<td>Human Embryology and Developmental Genetics</td>
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<td>HGL-521</td>
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<td>Current Trends in Medical Genetics</td>
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<td>HGL-523</td>
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<td>Genetics in Post-Genomic Era</td>
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<td>HGP-581</td>
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<td>HGL-532</td>
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<td>Human Genetics Research and Regulation</td>
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<td>HGL-533</td>
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<td>Advanced Course in Genetic Engineering</td>
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**Elective Course (3 Credits)**

<table>
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<th>Course No.</th>
<th>C/E/I</th>
<th>Course Title</th>
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**Total Credits**: 18 3 6 27

1. The students are required to opt for one ‘Elective’ paper.
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### Semester-IV

<table>
<thead>
<tr>
<th>Course No.</th>
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<tr>
<td>HGL-552</td>
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<td>Applied Human Molecular Genetics</td>
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<tr>
<td>HGL-554</td>
<td>C</td>
<td>Structural Biology and Pharmacogenomics</td>
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<tr>
<td>HGL-555</td>
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<td>Birth Defects and Dysmorphology</td>
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<td>HGP-552</td>
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*Topic of dissertation and name of supervisor to be finalized during Semester-II*
M.Sc. (Hons. School) Human Genetics (SEMESTER – I)
(Credit Based Continuous Evaluation Grading System)

**HGL-406 DNA TECHNOLOGY**

**Credits: 3-0-0**

**Unit-I**
Nucleic acid probes, Methods of labelling probes, Polymerase chain reaction (PCR) and applications, Principles and applications of Southern blotting, Northern blotting, Western blotting, Dot blotting, DNA footprinting, Two-dimensional gel electrophoresis (2DE) and Pulse-field gel electrophoresis.

**Unit-II**
An overview of recombinant DNA (rDNA) technology, Cloning vectors; Plasmids, Cosmids, Phagemids, Enzymes used in DNA technology — Restriction endonucleases, Ligases, Kinases and phosphatases, Linkers and adaptors, Construction of cDNA and genomic DNA libraries, Identification of specific cloned sequences, Applications of recombinant DNA technology, Safety issue in rDNA experiments.

**Unit-III**
Principles and applications of amplification refractory mutation system (ARMS), Single-strand conformational polymorphism (SSCP), Simple sequence length polymorphism (SSLP), Restriction fragment length polymorphism (RFLP), Denaturing high-pressure liquid chromatography (dHPLC), Denaturing gradient gel electrophoresis (DGGE), DNA sequencing, Serial analysis of gene expression (SAGE).
Books Recommended

M.Sc. (Hons. School) Human Genetics (SEMESTER – I)  
(Credit Based Continuous Evaluation Grading System)

**HGL-422 MEDICAL GENETICS**

**Credits: 3-1-0**

**Unit-I**  
Growth and development of medical genetics (1956-to-present), Role of genetics in medicine, Types of genetic disorders — single gene, chromosomal, multifactorial. Genetic disorders with classical Mendelian inheritance with examples, Medical relevance of meiosis and mitosis, Dominance and recessiveness, Mechanism of dominance, Concept of phenotype and relationship between genotype and phenotype in genetic disease.

**Unit-II**  
Concepts of genetic heterogeneity, Reduced penetrance, Variable expressivity, Pseudoautosomal inheritance, Genomic imprinting, Mosaicism, Uniparental disomy and Pleiotropy with suitable examples, Consequences of consanguineous marriages, Mitochondrial diseases.

**Unit-III**  
Pharmacogenetic diseases (Hereditary disorders with altered drug response, Malignant hyperthermia, G-6-PD deficiency), Chromosomal instability syndromes, Sex chromosomal and differentiation anomalies, Chromosomal microdeletion syndromes, Prion diseases, Gene mapping in DMD, CF, HD.

**Books Recommended**


HGL-423: METHODS OF RESEARCH DESIGN

Credits: 3-1-0

Unit-I
Common methods of Sampling: simple random, stratified, multistage, cluster and systematic random sampling. Probability proportional to size sampling. Non-random methods of sampling: convenience sample, snowball sampling. Questionnaire, Schedule, Advantage, Limitations and precautions of sampling, Prognostic and concomitant variables, Cohort and longitudinal study, Case-control and nested case-control design, Cross-sectional studies with merits and demerits, Sample size determination, general consideration and power analysis.

Unit-II
Magic threshold of p=0.05, Statistical significance and ‘P’-values, Dramatic P-values. Correlation versus cause-effect relationship and criteria for cause and effect. Null and alternative hypothesis, Type-I and Type-II errors, General procedure to obtain ‘P’-value, Test of methods through sensitivity, specificity and likelihood ratio, Positive and negative predictivity, Odds ratio for independent and matched samples.

Unit-III
Research problem, Objectives and hypothesis, Uses of sources of information such as journals, books, Index Medicus, Excerpta Medica, Biological Abstract, Science Citation Index, Preparing a manuscript for publication, Editing and galley proof correction of manuscript, Protocol content for research project, Scientific presentation. Punctuation and abbreviations in foot notes, precaution for writing research report, outlines of technical and popular report.
Books Recommended

M.Sc. (Hons. School) Human Genetics (SEMESTER – I)
(Credit Based Continuous Evaluation Grading System)

HGL-425 PERSPECTIVES OF HUMAN GENOME

Credits: 3-1-0

Unit-I
The Human Genome Project (HGP) — Historical perspective, goals and controversies, Human Genome Project organization, Overview of mapping strategies used in Human Genome Project, Draft and complete sequence of the Human Genome.

Unit-II

Unit-III
Overviews of the Phenome Project and the Metabolome Project. The Human connection and model organisms in genome projects: Escherichia coli, Saccharomyces cerevisiae, Caenorhabditis elegans, Drosophila melanogaster, Mouse, Rat, Pufferfish, Zebrafish, Monkey, Chimpanzee.

Book Recommended

Websites and Electronic References

http://www.nhgri.nih.gov/
http://www.hgmp.mrc.ac.uk/GenomeWeb/
http://www.ebi.ac.uk/~sterk/genome-MOT/
http://www-fp.mcs.anl.gov/~gaasterland/genomes.html
http://www.jax.org/
http://www.biol.tsukuba.ac.jp/
http://www.nuffieldbioethics.org
HGP-406: DNA TECHNOLOGY (PRACTICAL)

Credits: 0-0-2

Sterilization of glassware and plasticware, Preparation of stock solutions, Preparation of working solutions from stock solutions, Extraction of DNA by organic method, Quality checking of DNA by agarose gel electrophoresis, Quantification of DNA, Amplification of genomic DNA by PCR.
M.Sc. (Hons. School) Human Genetics (SEMESTER – I)
(Credit Based Continuous Evaluation Grading System)

HGP-422: MEDICAL GENETICS (PRACTICAL)

Credits 0-0-2

Analysis of different modes of inheritance, Numericals and case studies on medical genetics, Karyotyping from abnormal chromosomal preparations, Genetic databases — OMIM, London dysmorphology database, Possum, Repertox, Human cytogenetics database, Online medical genetics resources — OMIM, Gene clinics, Gene tests, ESHG; Sites for patients — Genetic Alliance, Family village.
The students will visit various research labs in the department for varying time span and will be examined for different practical techniques that they have learnt during the semester.
HGP-433: LAB ROTATIONS IN QUANTITATIVE GENETICS AND BIOINFORMATICS
(Elective Paper)

Credits: 0-0-3

The students will visit various research labs in the department for varying time span and will be examined for different practical techniques that they have learnt during the semester.
HGL-471: HUMAN MOLECULAR GENETICS AND FUNCTIONAL GENOMICS

Credits 3-1-0

Unit I


Unit II

Human transposons, DNA hybridization/denaturation and its significance, DNA Cot curves, Unique DNA and multigene families in humans, Repetitive DNA, Genetic mechanisms underlying pathogenic sequence exchanges in unique and repetitive DNA, Evolution of human mitochondrial genome, nuclear genome, sex chromosomes and DNA sequence families.

Unit III

Principles and applications of Real-Time PCR, Microarray and its applications, cDNA array, SNP array, oligonucleotide array, GWAS, Traditional DNA sequencing and next generation sequencing techniques, disease gene identification by exome sequencing, Clinical applications of exome sequencing.

Recommended Books:

M.Sc. (Hons. School) Human Genetics (Semester – II)  
(Credit Based Continuous Evaluation Grading System)

HGL-472: CLINICAL GENETICS AND GENETIC COUNSELLING

Credits: 3-1-0

**Unit-I**

**Unit-II**
Carrier screening — criteria for heterozygous screening programmes, Carrier testing for autosomal recessive and X-linked disorders, Risk calculations, Population screening for genetic disease — adult, newborn, Clinical utilization of presymptomatic and predispositional testing, Presymptomatic testing for genetic diseases and malignancy.

**Unit-III**
Genetic Counselling — Process, Role of genetic counsellors, Diagnostic problems in genetic counselling, Psychosocial aspects of genetic counselling, Genetic care pathway and preventive management guidelines. Role of social workers, nutritional, occupational, physical, speech therapist, psychologists and school professionals in genetics, Gene therapy and stem cell research in clinical genetics.

**Books Recommended**


M.Sc. (Hons. School) Human Genetics (Semester – II)  
(Credit Based Continuous Evaluation Grading System)

HGL-473: BIOETHICS AND HUMAN GENETICS

Credits: 3-1-0

Unit-I
History, scope and development of bioethics, Prescriptive and descriptive bioethics, Basic aspects of rights'-based ethical theory, duty-based ethical theory, utilitarian ethics.

Unit-II
Basic principles of bioethics (autonomy, non-maleficence, beneficience, justice, dignity, integrity, truth-telling, veracity, etc.). Informed consent and confidentiality, Bioethical maturity, Universality of bioethics and cross-cultural bioethics, Environmental ethics.

Unit-III
Vignettes on ethical dilemmas in medical genetic advances — Genethics, Genetic selection, Germline gene therapy, Genetic screening, Genetic determinism, Genome ownership, Genetic discrimination, Genetic insurance, Genetic privacy, ART, Modern eugenics, Euthanasia, Preconceptional and presymptomatic screening.

Books Recommended

M.Sc. (Hons. School) Human Genetics (Semester – II)  
(Credit Based Continuous Evaluation Grading System)

HGL-474: RECENT CONCEPTS IN HUMAN GENETICS

Credits 3-1-0

Unit I


Unit II

Epigenetic mechanisms, Histones and DNA modifications, Methods of analysis of DNA methylation, Methods of studying histone modifications, Inter-individual variations in DNA methylation, MHC complex and epigenetic mechanisms in gene regulation, Role of epigenetic mechanisms in human diseases; cancer, birth defects, epileptic disorders

Unit III


Recommended Books:

M.Sc. (Hons. School) Human Genetics (Semester – II)
(Credit Based Continuous Evaluation Grading System)

**HGS-475: SEMINAR**

**Credits: 0-0-1**

The paper is based on the seminars delivered by the students on current topics related to various disciplines of Human Genetics.
HGP-471: HUMAN MOLECULAR GENETICS AND FUNCTIONAL GENOMICS  
(PRACTICAL)  

Credits 0-0-3

DNA/RNA/Proteins quantification spectrophotometrically, Polymerase chain reaction (PCR), Analysis of PCR products by agarose gel electrophoresis, PCR-RFLP analysis, PCR-SSCP analysis, Demonstration of Real-Time PCR, Biological databases searches.
M.Sc. (Hons. School) Human Genetics (Semester – II)
(Credit Based Continuous Evaluation Grading System)

HGP-472: CLINICAL GENETICS (PRACTICAL)

Credits 0-0-2

Case studies, Designing proformae (Thalassemia, Primary amenorrhea, Mental retardation, Recurrent abortions, Prenatal screening questionnaire, Taking history, Preconceptional screening and counselling, Case management of selected genetic diseases (Congenital anomalies, Down syndrome, Achondroplasia, Marfan syndrome, Dysmorphology, and Clinical teratology). Genetic registers, importance and maintenance.
M.Sc. (Hons. School) Human Genetics (Semester – II)
(Credit Based Continuous Evaluation Grading System)

HGL-481: GENETICS OF HUMAN CANCER
(Elective Paper)

Credits: 3-0-0

Unit-I
Types of cancer, Origin and classification of cancer, Genetic basis of cancer, Role of tumorsuppressors and oncogenes in cancer, Gene-environment interactions, Cancer syndromes.

Unit-II
Cytogenetics in myeloid leukaemia, acute myeloid leukaemia, Myelodysplastic syndromes and myeloproliferative disorders, Cytogenetics of haematological neoplasm, Lymphomas and chronic lymphoproliferative disorders, MicroRNAs in cancer.

Unit-III
Genetic basis of solid tumors, Colorectal, breast and ovarian cancer, Uterine cancer, Solid tumor cytogenetics, Neoplasia-associated genomic arrangements, Cancer risk assessment.

Books Recommended

M.Sc. (Hons. School) Human Genetics (Semester – II)  
(Credit Based Continuous Evaluation Grading System)  

**HGL-482: TOOLS AND TECHNIQUES IN IMMUNOLOGY**  
(*Elective Paper*)  

**Credits: 3-0-0**

**Unit I**
Evaluation of antigen-antibody interaction by Immunelectron microscopy, microarray analysis, flow cytometry, Immunoelectrophoresis, Immunoprecipitation, agglutination assays, western blotting etc.; Immunolocalization of antigens

**Unit II**
Experimental systems in immunology including cell lines, knock out mice, knock in mice, SCID mice, SCID Human mice, Inbred strains, nude mice; Vaccines to prevent infectious diseases

**Unit III**
Cancer immunotherapy; Transplantation Immunology; HLA typing; Prolongation of allograft survival; Maternal–fetal incompatibility; Circumvention of autoimmune diseases

**Books Recommended:**

M.Sc. (Hons. School) Human Genetics (Semester-III)
(Credit Based Continuous Evaluation Grading System)

HGL-505: HUMAN EMBRYOLOGY AND DEVELOPMENTAL GENETICS

Credits: 3-0-0

Unit-I
Fertilization and molecular events during fertilization, and prenatal development of human embryo up to three germinal layers. differential gene activity and cell differentiation, Gastrulation, cleavage patterns, fate map during gastrulation, Notochord formation, Neurulation, Formation of somites, Structure of somites, Formation of blood vessels.

Unit-II
Implantation, Formation and types of placenta, Genetic and molecular control of development of head and neck region, development of nervous system.

Unit-III
Genetic and molecular control of development of limbs, gastrointestinal system and cardiovascular system, Genetics of sex determination in humans and development of urogenital system.

Books Recommended
M.Sc. (Hons. School) Human Genetics (Semester-III)
(Credit Based Continuous Evaluation Grading System)

HGL-521: CURRENT TRENDS IN MEDICAL GENETICS

Credits: 3-1-0

**Unit-I**

**Unit-II**
Personal genomics, Cell-based therapies, Nuclear reprogramming, Nuclear transplantation and its medical implications, Overview of Systems biology and Systems medicine.

**Unit-III**
Non-invasive prenatal testing and screening using parallel DNA sequencing. Case studies — genomics and patents; Overview of ecogenetics and genetic weapons, Synthetic biology and its applications.

**Books Recommended**

M.Sc. (Hons. School) Human Genetics (Semester-III)
(Credit Based Continuous Evaluation Grading System)

HGL-523: GENETICS IN POST-GENOMIC ERA

Credits: 3-1-0

Unit-I
Introduction to post-genomic era, Scope, Tools and Challenges in post-genomic era, High throughput methods; Next Generation and Third generation sequencing technologies.

Unit-II
Role of bioinformatics in post-genomic era, Data mining and management tools, Information retrieval from biological databases, Sequence annotation, Computational methods in comparative genomics, Proteomics in post-genomics era; Protein sequence databases, Protein structure prediction analysis.

Unit-III
Translational genomics, Genomic medicine; 1000 Genome project, Concept of personalised medicine, Introduction to pathway analysis, Basic concepts of node, pathway and networks, Tools for pathway analysis, Types; Knowledge driven and data driven.

Books Recommended:


M.Sc. (Hons. School) Human Genetics (Semester-III)
(Credit Based Continuous Evaluation Grading System)


HGL-524: ADVANCED CYTOGENETICS

Credits: 3-0-0

Unit-I
Process of cell culture, culture environment and media, Methods of culture, Types of cell culture systems, Maintenance and storage of culture, Cell-line banking, Scaling-up of cultures for tissue engineering and commercial culture, Stem cells, Cell quantitation methods and cytotoxicity assays.

Unit-II
Methods of cell imaging, Quantification of images, Transmitted light imaging, Principle and applications of fluorescent microscope, Confocal microscope, Scanning electron microscope, Flow cytometer, Fluorescent in situ hybridization technique and its applications: CGH, M-FISH, SKY, COBRA-FISH, CM-FISH, FIBRE-FISH, GISH, PRINS.

Unit-III
Human chromosome nomenclature for G-banded chromosome, Neoplasia, In situ hybridization, Microarray.

Books Recommended:

(Credit Based Continuous Evaluation Grading System)

**HGP-581: ADVANCED PRACTICALS**

**Credits: 0-0-6**

The students will have laboratory attachments with different faculty members for varying time span and will then be examined for different practical techniques that they have learnt during the semester.
M.Sc. (Hons. School) Human Genetics (Semester-III)
(Credit Based Continuous Evaluation Grading System)

HGL-532: HUMAN GENETICS RESEARCH AND REGULATION
(Elective Paper)

Credits: 3-0-0

Unit-I
Background of research on Human Genetics, Need for protection of human subjects in research, Development of medical oaths and research codes [Chakra samitha, Hippocratic oath (old and modern versions), Oath of Maimonides, Physician oath, Nuremberg code].

Unit-II

Unit-III

Books Recommended

10. World Medical Association: Declaration of Helsinki (Ethical Principles for Medical Research Involving Human Subjects).


M.Sc. (Hons. School) Human Genetics (Semester-III)
(Credit Based Continuous Evaluation Grading System)

HGL-533: ADVANCED COURSE IN GENETIC ENGINEERING
(Elective Paper)

Credits: 3-0-0

Unit-I
Cloning strategies in eukaryotic cells, Yeast cloning vectors, Yeast bacterial, PI artificial chromosomes (YACs, BACs and PACs), Expression vectors in prokaryotes, Translational and transcriptional fusions, Lac, Trp promoters, Hybrid promoters, λP1, promoter, and T7 expression system, Expression systems in yeast, Expression systems in insect cells, Non-biological and cell-mediated gene transfer, Genomic cDNA, Subtractive libraries, Arrayed and ordered libraries.

Unit-II
Expression in higher eukaryotic cells, General principles of transgene behaviour, position and integration effects, Tet-on/Tet-off system, Protein purification by tagging approach, Cell-free in vitro translation systems, Gene identification and library screening methods, Hybridization based, Immunoscreening, Methods to study protein interactions, Two hybrid screening, Phage display, Hybridoma technology.

Unit-III
Overview of reproductive engineering, Basic strategy for production of transgenic animals, Pronuclear microinjection, Gene transfer to embryonic stem cells, Gene targeting in animal cells by homologous and site-specific recombination, Design of targeting vectors, Cre-Lox system.

Books Recommended

M.Sc. (Hons. School) Human Genetics (Semester-IV)
(Credit Based Continuous Evaluation Grading System)

HGL-552: APPLIED HUMAN MOLECULAR GENETICS

Credits: 3-0-0

**Unit-I**
Principles and strategies in identifying disease gene, Genetic and physical mapping of human genome, Mapping and cloning of human disease genes, Direct and indirect DNA testing and its applications, DNA-based diagnosis of genetic diseases, Population screening.

**Unit-II**
Comparative genomic hybridization (CGH), DNA chips, DNA dragnets, Principles and application of denaturing high pressure liquid chromatography (dHPLC), Multiplex ligation-dependent probe amplification (MLPA), Mass spectrometry (MS), Tandem mass spectrometry (TMS), Next generation sequencing (NGS) and its applications.

**Unit-III**
Molecular genetics of retinoblastoma, Glaucoma, Marfan syndrome, DMD, Cystic fibrosis, Huntington's disease, Complex human diseases like NIDDM, Hypertension, Cardiovascular disorders, Obesity, Molecular genetics of mitochondrial disorders.

**Books Recommended**

M.Sc. (Hons. School) Human Genetics (Semester-IV)
(Credit Based Continuous Evaluation Grading System)

HGL-554: STRUCTURAL BIOLOGY AND PHARMACOGENOMICS

Credits: 3-0-0

Unit-I
Tertiary structures of DNA, Hoogstein base pairing, Triple helices, DNA topology, Supercoiling, Common structural motifs in RNA, General principles of protein structure, Primary structure, Peptide unit, Basic dipeptide unit, Introduction to Ramachandran plot, Secondary and tertiary structures, α-helix, β-sheet, Common three dimensional folds/motifs found in proteins and their mode of interaction with DNA.

Unit-II
Prediction of secondary structure from primary structure, Protein folding, Levinthal paradox, Physical nature of non-covalent interactions, Experimental methods for protein purification, Overview of methods used for determination of protein structure, Introduction to structural databases for protein studies.

Unit-III
Pharmacogenomics of obesity-related hypertension, Diabetes and other cardiovascular diseases, Basics of drug discovery, Role of functional genomics in new drug discovery and drugable genome, Genome-guided identification and validation of drug targets, Role of SNPs in drug discovery and development.

Books Recommended
M.Sc. (Hons. School) Human Genetics (Semester-IV)  
(Credit Based Continuous Evaluation Grading System)

HGL-555: BIRTH DEFECTS AND DYSMORPHOLOGY

Credits: 3-0-0

Unit-I
Syndromes, Dysmorphology and Birth defects, Evaluation of dysmorphology: Pregnancy history, Birth history, Medical history, Physical features, Diagnostic approach to dysmorphic patients, CHARGE and VACTERAL association, Indication for prenatal diagnosis.

Unit-II
Fetal disorders, Rhesus disease, Fetal alcohol syndrome, Stillbirth and neonatal death, Spontaneous abortion, Advanced maternal age, Abnormal ultrasound findings, Classification of birth defects, Minor and major congenital abnormalities, Teratogenic effect on development, Single gene defects, Multifactorial inheritance.

Unit-III
Microcephaly, Limb as developmental model and related syndromes, Errors of morphogenesis, Disorders of sexual differentiation, Disorders of sex chromosomes, Chromosome disorders and behavioural phenotypes, Role of genetic counselling in dysmorphology.

Books Recommended

M.Sc. (Hons. School) Human Genetics (Semester-IV)
(Credit Based Continuous Evaluation Grading System)


M.Sc. (Hons. School) Human Genetics (Semester-IV)
(Credit Based Continuous Evaluation Grading System)

**HGP-552: APPLIED HUMAN MOLECULAR GENETICS**
**(PRACTICAL)**

**Credits: 0-0-3**

DNA isolation, Amplification of genomic DNA by PCR, Agarose gel electrophoresis of amplified products, Polyacrylamide gel electrophoresis (PAGE), PCR-SSCP analysis, Demonstration of RT-PCR, Biological database searches (MEDLINE, NCBI, ENSEMBL, UCSC, GDB, PDB, HGMD, RetNet).
HGD-595: DISSERTATION

The topic of the dissertation and the name of the supervisor are to be finalized during Semester-II. Experimental work on dissertation project will begin in Semester-III. The dissertation is to be submitted before theory examinations of Semester IV.