# CENTRAL UNIVERSITY OF PUNJAB, BATHINDA



**Ph.D in Molecular Medicine**

**Session - 2020**

**Department of Human Genetics and Molecular Medicine**

**Programme Outcome**

Ph.D. Molecular Medicine is a multi-semester research program through which the students will be able to:
- Integrate translational sciences approaches for better understanding of human diseases.
- Target towards practical exposure of Molecular Biology tools used in disease research.

**Ph.D. Molecular Medicine Course Work**

| S.No. | Course Code | Course Title | L | T | P | Credit |
|-------|-------------|--------------|---|---|---|--------|
| 1 | LMM.701 | Research Methodology and Biostatistics | 4 | 0 | 0 | 4 |
| 2 | LMM.702 | Advanced Course in Molecular Medicine | 4 | 0 | 0 | 4 |
| 3 | CPE-RPF | Research and Publication Ethics | 2 | 0 | 0 | 2 |
|  | LMM.797 | Seminar | 0 | 0 | 0 | 2 |
| **TOTAL** | | | | | | 12 |

**LML.701: Research Methodology and Biostatistics**

| L | T | P | CR |
|---|---|---|----|
| 4 | 0 | 0 | 4 |

**Learning Outcomes:**

On successful completion of the course the student will be able to:
- Analyze and evaluate wide variety of statistical data
- Represent statistical data and summary statistics in graphical and tabular forms
- Apply suitable statistical tools to analyze data
  Write and communicate scientific reports, projects and publications

**UNIT I**                                                          **Hours: 14**

**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**: Technical and scientific writing: thesis, technical papers, reviews, electronic communication, research papers, etc. Poster preparation and Presentations and Dissertation. Reference management using various softwares: Endnote, reference manager, refwork, etc. Communication skills – defining communication, types of communication, techniques of communication, etc.

**UNIT II**                                                         **Hours: 14**

**Intellectual Property Rights:** Intellectual Property, intellectual property protection (IPP) and intellectual property rights (IPR), WTO (World Trade Organization), WIPO (World Intellectual Property Organization), GATT (General Agreement on Tariff and Trade), TRIPs (Trade Related Intellectual Property Rights), TRIMS (Trade Related Investment Measures) and GATS (General Agreement on Trades in Services), Nuts and Bolts of Patenting, Technology Development/Transfer Commercialization Related Aspects, Ethics and Values in IP.

**UNIT III**                                                        **Hours: 18**

**Biostatistics:** Difference between parametric and non-parametric statistics, Univariant and multivariant 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

**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

**Regression and correlation:** Standard errors of regression coefficients, Comparing two regression lines, Pearson Product - Moment Correlation Coefficient, Spearman Rank correlation coefficient, Power and sampling size in

correlation and regression.

**UNIT IV**                                                                    **Hours: 14**

**Fundamentals of computer:** Parts of computer, Hardware, BIOS, Operating systems, Binary system, Logic gates and Boolean algebra. Application software: Spreadsheet applications, Word-processing applications, Presentation applications, Internet browsers, Reference Management, and Image processing applications. Computer language: Basic DOS commands, AutoHotKey scripting language, HTML and basic structure of a webpage, Designing websites. World wide web: Origin and concepts, Latency and bandwidth, Searching the internet, Advanced web-search using Boolean logic, Cloud computing.

**Transactional Modes:** Lecture**;** Tutorial**;** Problem solving; Self-learning.

**Suggested Readings:**
1.  Norman, G. and Streiner, D. (2008). *Biostatistics: The Bare Essentials.* (with SPSS), 4th Edition, People's Medical Publishing House, USA.
2.  Sokal, R.R. and Rohlf, F.J. (1994). *Biometry: The Principles and Practices of Statistics in Biological Research.* 4th Edition, W.H. Freeman publishers, USA.
3.  Banerjee P.K (2014). *Introduction to Biostatistics.* S.Chand, India
4.  Daniel WW (2010). *Biostatistics*: *A Foundation for Analysis in the Health Sciences.* John Wiley and Sons Inc.
5.  Bailet NTJ. *Statistical Methods in Biology.* Cambridge Univ. Press.
6.  Glaser AN. *High-Yield Biostatistics.* Lippincott Williams & Wilkins.
7.  Gupta, S. (2008). *Research Methodology and Statistical Techniques.*Deep and Deep Publications (P) Limited, New Delhi.
8.  Kothari, C. R. (2014). *Research Methodology (s).*New Age International (p) Limited. NewDelhi.
9.  Sahay, Vinaya and Pradumna Singh (2009). *Encyclopedia of Research Methodology in life Sciences.* Anmol Publications. New Delhi

**LMM.702: Advanced Course in Molecular Medicine**

| L | T | P | CR |
|---|---|---|----|
| 4 | 0 | 0 | 4 |

**Learning Outcomes:**
On successful completion of the course the student will be able to:
- Understand molecular medicine i.e. molecular/cell biology relevant to medical applications.
- Understand how normal cellular processes change, fail or are destroyed by disease development, in particular for genetic diseases and role of modern therapeutics.

**Unit: I**                                                                    **Hours: 15**
**Molecular basis of Metabolic, Infectious and Non-infectious diseases:** Human genetics relevant to molecular medicine, human genome organization and variations, single nucleotide polymorphisms, multiple gene polymorphisms, single and multi-gene diseases, gene-environment interactions in disease manifestation, genetic and physical mapping of human genome and identification of diseases gene, gene therapy and recombinant molecules in medicine and therapeutic development. Antiviral therapies, vehicles for genetic therapies, construction of knock-out and transgenic animals.

**Unit: II**                                                                   **Hours: 15**
**Signal Transduction and its Role in Human Diseases:** Cellular and tissue microenvironment in diseases, drug resistance with convention chemotherapies, clinical trials, adjuvant therapies, monoclonal antibodies as drugs, nanobiotechnology and its applications in molecular medicine, next generation sequencing techniques.

**Unit: III**                                                                  **Hours: 15**
**Stem Cells and Regenerative Medicine:** Stem cells and their properties, classification of stem cells: Hematopoietic Stem Cells, mesenchymal Stem Cells, Embryonic Stem Cells, Fetal Stem Cells, adult stem cells, cancer stem cells, isolation, identification and characterization of stem cells, tissue and organ culture, tissue Engineering and transplantation techniques.

**Unit: IV**                                                                   **Hours: 15**
**Molecular Pharmacogenetics and Therapeutics:** Gene therapy and recombinant molecules in medicine and therapeutic development. Antiviral therapies, vehicles for genetic therapies, construction of knock-out and transgenic animals,  Stem cell research and its application in human health, pharmacogenomics, its application and role in developing novel therapies. RNAi and human diseases, alternate splicing and human disease

**Transactionalal Modes:** Lecture**;** Tutorial**;** Problem solving; Self-learning.

**Suggested Reading:**
1.  Littwack, G. (2008). *Human Biochemistry and Disease.*Academic Press.

2. Trent, R. J. (2012). *Molecular Medicine,* Fourth Edition: Genomics to Personalized Healthcare. Academic Press.
3. Elles, R., Mountfield, R. (2011). *Molecular Diagnosis of Genetic Diseases.*Springer Publication.
4. Lanza, R., Gearhart,J. (2009). *Essential of Stem Cell Biology.* Elsevier Academic Press.
5. Lanza, R., Klimanskaya, I. (2009). *Essential Stem Cells Methods.* Academic Press.
6. Mao, J. J., Vunjak-Novakovic (2008). *Translational Approaches in Tissue Engineering & Regenerative Medicine.* Artech House INC Publications.
7. Lanza, R. (2007). *Principles of Tissue Engineering, 3rd Edition.* Academic Press.
8. Stein. (2011). *Human Stem Cell Technology and Biology: A Research Guide and Laboratory Manual.* Wiley-Blackwell.

**Related Weblinks:**
1. www.stemcells.wisc.edu
2. http://stemcells.nih.gov/info/scireport/Pages/2006report.aspx
3. *stemcells.nih.gov/*
4. http://instem.res.in/

**CPE.RPF: Research and Publication Ethics**

| L | T | P | CR |
|---|---|---|----|
| 2 | 0 | 0 | 2 |

**Learning Outcomes:**
On successful completion of the course the student will be able to:
- Improve communication aptitude
- Learn presenting paper or data in scientific

## THEORY

**RPE 01:  Philosphy and Ethics**                                      Hours: 5
- Introduction to philosophy:  Detention, nature and scope, concept, branches
- Ethics: definition, moral philosophy, nature of moral judgments and reactions

**REP 02: Scientific conduct**                                         Hours:  5
- Ethics with respect to science and research
- Intellectual honesty and research integrity.
- Scientific misconduct: Falsification, Fabrication and Plagiarism (FFP)
- Redundant publications: duplicate and overlapping publication, salami slicing
- Selective reporting and misrepresentation of data.

**RPE 03: Publication ethics**                                         Hours: 5
- Publication ethics: definition, introduction and importance
- Best practice/ standards setting initiatives and guidelines: COPE, WAME, etc.
- Conflicts of interest
- Publication misconduct: definition, concept, problems that leads to unethical behavior and vice versa, types
- Violation of publication ethics, authorship and contribution ship
- Identification of publication misconduct, complaints and appeals
- Predatory publishers and journals

## PRACTICE

**RPE 04: Open access publishing**                                     Hours: 5
- Open access publications and initiatives
- SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
- Software tool to identify predatory publications developed by SPPU
- Journal finder / journal suggestion tools viz., JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

**RPE 05: Publication misconduct**

| L | T | P | CR |
|---|---|---|----|
| 4 | 0 | 0 | 4  |

A. Group Discussion

  Hours: 3
- Subject specific ethical issues, FFP, authorship
- Conflicts of interest
- Complaints and appeals: examples and fraud from India and abroad

B. Software tools            Hours: 2
- Use of plagiarism software like Turnitin, Urkund, and other open source software tools

**RPE 06: Databases and Research metrics**      **Hours: 5**

A. Databases               Hours: 3
- Indexing databases
- Citation databases: Web of Science, Scopus, etc.

B. Research Metrics             Hours: 2
- Impact Factor of journal as per Journal Citation Report, SNP, SJR, IPP, Cite Score
- Metrics: h-index, g index, i10 index, altmetrics

Transactional Modes: Lecture; Demonstration; Tutorial; Quiz; Lecture cum demonstration; Problem solving; Self-learning.

**LMM.797: Seminar**

| L | T | P | CR |
|---|---|---|----|
| 0 | 0 | 0 | 2  |

**Learning Outcomes:**

On successful completion of the course the student will be able to:
- Improve communication aptitude
- Learn presenting paper or data in scientific forum

**Evaluation criteria:**
- A. The performance of the students will be continuously evaluated based on the choice of the topic, preparation of the topic, referring new research in the area and also discussing the future perspective = 50 marks
- B. Final presentation and report writing = 50 marks