

Central University of Punjab, Bathinda
Centre For Human Genetics and Molecular Medicine
 Ph.D. Life Sciences Specialization in Molecular Medicine

Ph.D. Molecular Medicine Course Work

S.No.	Course Code	Course Title	L	T	P	Cr	E
1	LMM.701	Research Methodology and Biostatistics	5			5	100
2	LMM.702	Advanced Course in Molecular Medicine	5	-	-	5	100
3	LMM.797	Seminar	-	-	-	1	100
TOTAL						11	300

LML.701: Research Methodology and Biostatistics

Credit Hours: 5.

Learning Objective: This course will help students to understand the complex outcome of their results using biostatistical approaches in testing hypothesis, designing experiments, analyzing experimental data and interpreting the results of biological research.

Unit:1

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. **Bibliographic index and research quality parameters-** citation index, impact factor, *h* index, *i10* index, etc. Research engines such as google scholar, Scopus, web of science, etc. **Technical & scientific writing:** Technical & Scientific writing - theses, technical papers, reviews, electronic communication, research papers, etc., Poster preparation and Presentation and Dissertation. Reference Management using various softwares such as Endnote, reference manager, Refworks, etc. Communication skills – defining communication; type of communication; techniques of communication, etc.

Library: Classification systems, e-Library, Reference management, Web-based literature search engines

Unit:2

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. **Plagiarism:** Plagiarism, definition, Search engines, regulations, policies and documents/thesis/manuscripts checking through softwares, Knowing and Avoiding Plagiarism during documents/thesis/manuscripts/ scientific writing.

Unit:3

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

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

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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: 4

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.

Suggested Reading:

1. Gupta, S. (2008). *Research Methodology and Statistical Techniques*. Deep and Deep Publications (P) Limited, New Delhi.
2. Kothari, C. R. (2014). *Research Methodology (s)*. New Age International (p) Limited. New Delhi.
3. Sahay, Vinaya and Pradumna Singh (2009). *Encyclopedia of Research Methodology in life Sciences*. Anmol Publications. New Delhi
4. Kauda J. (2012). *Research Methodology: A Project Guide for University Students*. Samfunds Literature Publications.
5. Dharmapalan B. (2012). *Scientific Research Methodology*. Narosa Publishing House ISBN: 978-81-8487-180-7.
6. Norman, G. and Streiner, D. (2008). *Biostatistics: The Bare Essentials*. 3/e (with SPSS). Decker Inc. USA.
7. Rao, P. P., Sundar, S., and Richard, J. (2009). *Introduction to Biostatistics and Research Methods*. PHI learning.
8. Christensen, L. (2007). *Experimental Methodology*. Boston: Allyn & Bacon.
9. Clive Opie (2004). *Doing Educational Research- A Guide for First time Researchers*. New Delhi: Vistar Publications.
10. Fraenkel, J.R., Wallen, N.E. (2009). *How to Design and Evaluate Research in Education*. 7th edition, New York: McGraw Hill.
11. Kumar Ranjit (2011). *Research Methodology: A Step-by-Step Guide for Beginners Field*. Sage Publications.

LMM.702: Advanced Course in Molecular Medicine **Credit Hours: 5.**

Learning Objective: The students will understand the background of molecular medicine i.e. molecular/cell biology relevant to medical applications. It will enhance their understanding how normal cellular processes change, fail or are destroyed by disease development, in particular for genetic diseases and role of modern therapeutics

Unit:1

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:2

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:3

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:4

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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

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/>

LMM.797: Credit Seminar

Credit Hours: 1.

Learning 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:

Learning 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.