

# **CENTRAL UNIVERSITY OF PUNJAB**



Ph.D in Molecular Medicine

**Session 2021-22**

**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.

## Course Structure of the Programme

Course Code	Course Title	Course type	Hours			Credit
			L	T	P	
MME.701	Research Methodology and Biostatistics	Core course	4	0	0	4
MME.702	Advanced Course in Molecular Medicine	Core course	4	0	0	4
MME.751	Research and Publication Ethics	Core course	4	0	0	2
MME.752	Teaching Assistantship		0	0	2	1
UNI.753	Curriculum, Pedagogy and Evaluation		1	0	0	1
MME.797	Seminar	Skill based	4	0	0	2
<b>TOTAL</b>						<b>14</b>

## Details of syllabus

**Course Code:** MME.701  
**Course Title:** Research Methodology and Biostatistics  
**Total Hours:** 60

L	T	P	C
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, 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

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.

**Internal assessment shall be through any of the following:** Surprise Tests, one sentence summary, case analysis, simulated problem solving, open book techniques, classroom assignments, homework assignments, term paper, presentations and discussions.

**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

**Course Code:** MME.702  
**Course Title:** Advanced Course in Molecular Medicine  
**Total Hours:** 60

L	T	P	C
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

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

**Internal assessment shall be through any of the following:** Surprise Tests, one sentence summary, case analysis, simulated problem solving, open book techniques, classroom assignments, homework assignments, term paper, presentations and discussions.

**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:**

- [www.stemcells.wisc.edu](http://www.stemcells.wisc.edu)
- <http://stemcells.nih.gov/info/scireport/Pages/2006report.aspx>
- [stemcells.nih.gov/](http://stemcells.nih.gov/)
- <http://instem.res.in/>

**Course Code: MME.751**

**Course Title: Research and Publication Ethics**

L	T	P	Credits
2	0	0	2

**Total Hours: 30**

**Unit I Philosophy and Ethics****3 hours**

- Introduction to Philosophy : definition, nature and scope, content, branches
- Ethics : definition, moral philosophy, nature of moral judgements and reactions

**Unit II Scientific Conduct****5 hours**

- Ethics with respect to science and research
- Intellectual honesty and research integrity
- Scientific misconducts : Falsification, Fabrication, and Plagiarism (FFP)
- Redundant publications : duplicate and overlapping publications, salami slicing
- Selective reporting and misrepresentation of data

**Unit III: Publication Ethics****7 hours**

- Publication ethics : definition, introduction and importance
- Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc.
- Conflicts of interest
- Publication misconduct : definition, concept, problems that lead to unethical behaviour and vice versa, types
- Violation of publication ethics, authorship and contributor ship
- Identification of publication misconduct, complaints and appeals
- Predatory publishers and journals

**Unit IV Open Access publishing****4 hours**

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

**Unit V Publication Misconduct****4 hours**

- Group Discussions: Subject specific ethical issues, FFP, authorship; conflicts of interest; complaints and appeals: examples and fraud from India and abroad
- Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools

**Unit IV Databases and Research Metrics****7 hours**

- Databases: Indexing databases; Citation database: Web of Science, Scopus etc.
- Research Metrics: Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics : h-index, g-index, i10 index, almetrics

**Course Code: MME.752**

**Course Title: TEACHING ASSISTANTSHIP**

L	T	P	Credit
0	0	2	1

**Total Hours: 30**

**Learning Outcome:**

At the end of this skill development course, the scholars shall be able to

1. familiarize themselves with the pedagogical practices of effective class room delivery and knowledge evaluation system
2. manage large and small classes using appropriate pedagogical techniques for different types of content

**Activities and Evaluation:**

- The scholars shall attend Master degree classes of his/her supervisor to observe the various transaction modes that the supervisor follows in the class room delivery or transaction process one period per week.
- The scholars shall be assigned one period per week under the direct supervision of his/her supervisor to teach the Master degree students adopting appropriate teaching strategy(s).
- The scholars shall be involved in examination and evaluation system of the Master degree students such as preparation of questions, conduct of examination and preparation of results under the direction of the supervisor.
- At the end of the semester, the supervisor shall conduct an examination of teaching skills learned by the scholar as per the following evaluation criteria:
- The scholars shall be given a topic relevant to the Master degree course of the current semester as his/her specialization to prepare lessons and deliver in the class room before the master degree students for one hour (45 minutes teaching + 15 minutes interaction).
- The scholars shall be evaluated for a total of 50 marks comprising content knowledge (10 marks), explanation and demonstration skills (10 marks), communication skills (10 marks), teaching techniques employed (10 marks), and classroom interactions (10 ).

**Course Code: UNI.753**

**Course Title: CURRICULUM, PEDAGOGY AND EVALUATION**

L	T	P	Credit
1	0	0	1

**Learning outcomes:**

**Total Hours: 15**

After completion of the course, scholars shall be able to:

- analyze the principles and bases of curriculum design and development
- examine the processes involved in curriculum development
- develop the skills of adopting innovative pedagogies and conducting students' assessment
- develop curriculum of a specific course/programme

## **Course Content**

### **Unit I Bases and Principles of Curriculum 4 hours**

1. Curriculum: Concept and Principles of curriculum development, Foundations of Curriculum Development.
2. Types of Curriculum Designs- Subject centered, learner centered, experience centered and core curriculum. Designing local, national, regional and global specific curriculum. Choice Based Credit System and its implementation.

### **Unit II Curriculum Development 4 hours**

1. Process of Curriculum Development: Formulation of graduate attributes, course/learning outcomes, content selection, organization of content and learning experiences, transaction process.
2. Comparison among Interdisciplinary, multidisciplinary and trans-disciplinary approaches to curriculum.

### **Unit III Curriculum and Pedagogy 3 hours**

1. Conceptual understanding of Pedagogy.
2. Pedagogies: Peeragogy, Cybergogy and Heutagogy with special emphasis on Blended learning, Flipped learning, Dialogue, cooperative and collaborative learning
3. Three e- techniques: Moodle, Edmodo, Google classroom

### **Unit IV Learners' Assessment 4 hours**

1. Assessment Preparation: Concept, purpose, and principles of preparing objective and subjective questions.
2. Conducting Assessment: Modes of conducting assessment – offline and online; use of ICT in conducting assessments.
3. Evaluation: Formative and Summative assessments, Outcome based assessment, and scoring criteria.

## **Transaction Mode**

Lecture, dialogue, peer group discussion, workshop

## **Evaluation criteria**

There shall be an end term evaluation of the course for 50 marks for duration of 2 hours. The course coordinator shall conduct the evaluation.

## **Suggested Readings**

- Allyn, B., Beane, J. A., Conrad, E. P., & Samuel J. A., (1986). Curriculum Planning and Development. Boston: Allyn & Bacon.



- Brady, L. (1995). Curriculum Development. Prentice Hall: Delhi. National Council of Educational Research and Training.
- Deng, Z. (2007). Knowing the subject matter of science curriculum, Journal of Curriculum Studies, 39(5), 503-535. <https://doi.org/10.1080/00220270701305362>
- Gronlund, N. E. & Linn, R. L. (2003). Measurement and Assessment in teaching. Singapore: Pearson Education
- McNeil, J. D. (1990). Curriculum: A Comprehensive Introduction, London: Scott, Foreman/Little
- Nehru, R. S. S. (2015). Principles of Curriculum. New Delhi: APH Publishing Corporation.
- Oliva, P. F. (2001). Developing the curriculum (Fifth Ed.). New York, NY: Longman
- Stein, J. and Graham, C. (2014). Essentials for Blended Learning: A Standards-Based Guide. New York, NY: Routledge.

**Web Resources**

- [https://www.westernsydney.edu.au/\\_data/assets/pdf\\_file/0004/467095/Fundamentals\\_of\\_Blended\\_Learning.pdf](https://www.westernsydney.edu.au/_data/assets/pdf_file/0004/467095/Fundamentals_of_Blended_Learning.pdf)
- <https://www.uhd.edu/academics/university-college/centers-offices/teaching-learningexcellence/Pages/Principles-of-a-Flipped-Classroom.aspx>
- <http://leerwegdialoog.nl/wp-content/uploads/2018/06/180621-Article-The-BasicPrinciples-of-Dialogue-by-Renate-van-der-Veen-and-Olga-Plokhooij.pdf>

**Course Code: MME.797**  
**Course Title: Seminar**  
**Total Hours: 30**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**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

Seminar topics will be decided jointly by PhD supervisor and the student and will be presented in open house. Seminar presentation will be followed by open discussion.

**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