CENTRAL UNIVERSITY OF PUNJAB

Ph.D in Molecular Medicine

Batch 2022-23

Department of Human Genetics and Molecular Medicine

Graduate Attributes

The students graduating in Molecular Medicine will contribute to the teaching and research at local, regional, national and international levels. This programme will enrich students with fundamental knowledge of research ethics, translational research, and regenerative medicine. On successful completion of this programme, the students will be able to:

- ➢ Integrate translational sciences approaches for better understanding of human diseases.

- ➢ Integrate multidisciplinary approaches to analyze the molecular biomarkers and therapeutics in pathogenic conditions.

- ➢ Target towards practical exposure of Molecular Biology tools used in disease research.

- ➢ Compete at national and global level to pursue research and teaching in the field of healthcare and life sciences

- ➢ Contribute to the scientific workforce that will transform molecular diagnostics and healthcare sectors employing higher order thinking skills and capabilities.

Course Structure of the Programme

Course Code	Course Title	Course type	Hours			Credit
			L	T	P	
HGE.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	Skill Based	0	0	2	1
UNI.753	Curriculum, Pedagogy and Evaluation	Skill Based	1	0	0	1
MME.797	Seminar/Journal Club	Skill based	0	0	4	2
					TOTAL	**14**

Details of syllabus

	L	T	P	C
Course Code: MME.701				
Course Title: Research Methodology and Biostatistics	4	0	0	4
Total Hours: 60				

Learning Outcomes:

On successful completion of the course the student will be able to:

1. Analyze and evaluate wide variety of statistical data and research writing
2. Perform research and develop knowledge on Intellectual Property Rights
3. Perform statistical data analysis
4. Gather basic knowledge on computer systems and utilize them for research

Unit 1 **15 Hours** 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.	**CLO1**
Unit 2 **15 Hours** 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.	**CLO2**
Unit 3 **15 Hours** 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.	**CLO3**
Unit 4 **15 Hours** 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.	**CLO4**

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

		L	T	P	C
Course Code:	**MME.702**	**4**	**0**	**0**	**4**
Course Title:	**Advanced Course in Molecular Medicine**				
Total Hours:	**60**				

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.
- Understanding concepts of stem cell biology
- Conceptualize the advances in molecular pharmacogenetics and therapeutics

Unit 1 **15 Hours** 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	**CLO1**

medicine and therapeutic development. Antiviral therapies, vehicles for genetic therapies, construction of knock-out and transgenic animals.	
Unit 2 **15 Hours** 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.	**CLO2**
Unit 3 **15 Hours** 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.	**CLO3**
Unit 4 **15 Hours** 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	**CLO4**

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://stemcells.nih.gov/info/scireport/Pages/2006report.aspx
- stemcells.nih.gov/
- http://instem.res.in/

	L	T	P	C
Course Code: MME.751	2	0	0	2

Course Code: **MME.751**
Course Title: **Research and Publication Ethics**
Total Hours: **30**

Learning Outcomes:
On successful completion of the course the student will be able to:
- Understand the philosophy of research
- Perform good research practices
- Write scientific literature for peer reviewed publication
- Perform scientific literature writing in an efficient manner

Unit 1 **5 Hours** **Philosphy and Ethics** • Introduction to philosophy: Detention, nature and scope, concept, branches • Ethics: definition, moral philosophy, nature of moral judgments and reactions	**CLO1**
Unit 2 **5 Hours** **Scientific conduct** • 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.	**CLO2**
Unit 3 **5 Hours** **Publication ethics** • 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	**CLO3**
Unit 4 **15 Hours** **Open access publishing** • 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. **Publication misconduct** **A. Group Discussion** • Subject specific ethical issues, FFP, authorship, Conflicts of interest • Complaints and appeals: examples and fraud from India and abroad **B. Software tools** • Use of plagiarism software like Turnitin, Urkund, and other open source software tools **Databases and Research metrics** A. Databases • Indexing databases • Citation databases: Web of Science, Scopus, etc.	**CLO4**

B. Research Metrics	
• 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.

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.

Course Code: MME.752

Course Title: TEACHING ASSISTANTSHIP

Total Hours: 30

L	T	P	C
0	0	2	1

Learning Outcomes:

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

1. Familiarize themselves with the pedagogical practices of effective classroom 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

Total Hours: 30

L	T	P	C
2	0	0	2

Learning Outcomes:

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

CLO1 Analyze the principles and bases of curriculum design and development

CLO2 Examine the processes involved in curriculum development

CLO3 Develop the skills of adopting innovative pedagogies and conducting students' assessment
CLO4 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.	**CLO1**
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.	**CLO2**
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	**CLO3**
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.	**CLO4**

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.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	L	T	P	C
Course Title:	Seminar/Journal Club	0	0	4	2
Total Hours:	30				

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/Journal Club topics will be decided jointly by PhD supervisor and the student and will be presented in open house, 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