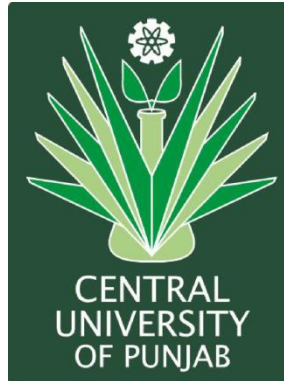# Central University of Punjab

Ph.D. Program in Biochemistry
Batch - 2024

Department of Biochemistry

Graduate Attributes

Students graduating from the program will contribute to the teaching and research needs in biochemistry and life sciences in academia, industry and research institutions at local, regional, national and international levels. They will be part of the scientific workforce that will transform health and agriculture sectors employing higher order thinking skills and capabilities.

Ph.D. Program in Biochemistry
Course Structure of the Program

Course Code	Course Title	L	P	Cr
BCH.701	Research Methodology and Computer Applications	4	-	4
BCH.702	Trends in Biochemistry	4	-	4
BCH.751	Research and Publication Ethics	2	-	2
BCH.752	Teaching Assistantship	0	2	1
UNI.753	Curriculum, Pedagogy and Evaluation	1	0	1
	Total Credits			**12**

L: Lectures; P: Practical; Cr: Credits

Course Code: BCH.701
Course Title: Research Methodology and Computer Applications

L	T	P	Credits
4	0	0	4

Learning Outcomes
Students will be able to:
CLO 1: Critically analyse, interpret, and synthesize existing scientific knowledge based on literature review.
CLO 2: Identify the knowledge gap and formulate a hypothesis and design experimental/theoretical work.
CLO 3: Apply good laboratory practices and biosafety protocols.
CLO 4: Apricate the crucial issues in research ethics, like responsibility for research, ethical clearance for experimental studies and scientific misconduct.
CLO 5: Perform hypothesis testing on small and large data samples.
CLO 6: Use correlation and linear regression methods to find a relationship and good of a fit for the given data.
CLO 7: Retrieve various biological data from the appropriate databases for analysis.
CLO 8: Compare protein structures and perform structure-based drug designing.

Unit/ Hours	Content	Mapping with CLO
I 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. Bibliographic index **Technical Writing:** Scientific writing, writing synopsis, Research paper, Poster preparation, oral presentations and Dissertations. Reference Management using various softwares such as Endnote, reference manager, Refworks, etc. Communication skills: defining communication; type of communication; techniques of communication, etc.	CLO 1 & CLO 2
II 15 hours	**Introduction and Principles of Good Lab Practices:** Good laboratory practices, Biosafety for human health and environment. Biosafety issues for using cloned genes in medicine, agriculture, industry, and eco-protection, Biological containment and physical containment, Biosafety in Clinical	CLO3 & CLO4

	laboratories and biohazard management, Physical, Chemical & Biological hazards and their mitigation. Biosafety level/category of pathogens. Biosafety level of laboratories, WHO/CDC/DBT guidelines for biosafety. **Research Ethics:** Ethical theories, Ethical considerations during research, consent. Animal handling/testing, Animal experimental models and animal ethics. Perspectives and methodology & Ethical issues of the human genome project, ICMR guidelines for biomedical and health research. 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). Patents, Technology Development/Transfer Commercialization Related Aspects, Ethics.	
III 15 hours	**Computer Applications and Biostatistics:** Introduction to spreadsheet, presentation tools. Reference Management software. Role of Cloud computing and HPC in life science research. Introduction to Big data in biology and big data analytics. Data types and sources – variables and types. Descriptive statistics of categorical data and continuous data. Estimation of parameters – hypothesis testing: tests of significance, type I and II errors, z test, t test, analysis of variance (ANOVA), chi-square goodness-of-fit test. Regression and correlation. Statistical packages and their applications.	CLO 5 & CLO 6
IV 15 hours	**Bioinformatics:** Biological data: sequence, structure, gene expression, pathways and molecular interactions. Primary Sequence and structure databases. GEO, KEGG Database. Introduction to Next generation Sequencing. Proteomics: Resources & repositories. Sequence analysis: Pair-wise sequence comparison, database searching methods-BLAST, FASTA, PHI-BLAST and Multiple sequence	CLO 7 & CLO 8

alignment. Molecular phylogeny-building phylogenetic trees. Introduction to Protein structure, Structure comparison and visualization, Structure based protein classification: CATH and SCOP. Introduction to structure-based drug designing. Structural genomics initiatives. Deep Learning in protein structure prediction and Biomedical Image analysis.	

Suggested Reading:
1. Gupta, S. (2010). *Research Methodology and Statistical Techniques.* Deep & Deep Publications (P) Limited, New Delhi.
2. Kothari, C.R., Garg, G. (2019). *Research Methodology: Methods and Techniques.* 4th Edition, 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
6. Norman, G. and Streiner, D. (2014). *Biostatistics:* The Bare Essentials. 4th Edition, PMPH-USA Limited.
7. Rao, P. P., S. Sundar and Richard, J. (2009). *Introduction to Biostatistics and Research Methods.* PHI learning.
8. Christensen, L. (2007). *Experimental Methodology.* Boston: Allyn & Bacon.
9. Fleming, D. O. and Hunt, D.L. (2006). *Biological Safety: Principles and Practices.* American Society for Microbiology, USA.
10. Rockman, H. B. (2004). *Intellectual Property Law for Engineers and Scientists.* Wiley-IEEE Press, USA.
11. Shannon, T. A. (2009). *An Introduction to Bioethics.* Paulist Press, USA.
12. Vaughn, L. (2012). *Bioethics: Principles, Issues, and Cases.* 2nd Edition, Oxford University Press, UK
13. Lesk, A.M. (2019). Introduction to Bioinformatics. 5th Edition, Oxford University Press, UK.
14. Ramsden, J. (2021). Bioinformatics: An Introduction (Series: Computational Biology). 4th Edition, Springer International Publishing.
15. Mount. D.W. (2004) Bioinformatics: Sequence and Genome Analysis. 2nd Ed., CSHL Press, New York.
16.Branden, C. and J. Tooze, (1999) Introduction to Protein Structure, 2nd Ed., Garland Science, USA.

Course Code: BCH.702
Course Title: Trends in Biochemistry

L	T	P	Credits
4	-	-	4

Learning Outcomes

Students will be able to:

CLO1: Understand and apply recent advances in macromolecule metabolism and biochemical toxicology to deliverable solutions in the field of agriculture and human health

CLO2: Understand the host-pathogen interaction and various defense pathways in hosts.

CLO3: Analyze varied clinical diseases in terms of biochemical dysregulation and deliverables in terms of disease diagnosis and treatment

CLO4: Correlate advances in biochemistry with advancement in bioanalytical techniques

Unit/ Hours	Contents	Mapping with CLO
I 15 Hours	**Macromolecule metabolism and biochemical toxicology** Amino Acid, Carbohydrate, Lipid, and Nucleotide Metabolism: Recent trends in xenobiotics; transportation, metabolic fate, and biotransformation. Application of xenobiotic metabolism in food and disease. Microbial and biochemical modulators of xenobiotics. Recent trends based on the literature	CLO1
II 15 Hours	Pathogenicity of microorganisms: plant-microbes interaction, Human pathogenic microbes, microbial virulence factors, Biofilms, Antimicrobial Drugs resistance and tolerance, defense mechanism in plants, Plant, and microbe's effector-triggered Immunity (ETI), Secondary Metabolites as defense molecules in Plants:	CLO2
III 15 Hours	**Disease Biology:** Molecular and biochemical advances in disease biology. Recent advances in understanding disease etiology, diagnosis, prognosis and treatment viz diseases associated with metabolic, immunological, genetic dysfunction (Diabetes and cardiovascular disease, Cancers, Neurological diseases, genetic diseases, autoimmune diseases, immune-deficient diseases, infectious diseases). Disease-associated molecular mechanisms and signaling pathways. Disease biomarkers. Stress and disease biology Plant pathologies and remedies.	CLO3

IV 15 Hours	**Advanced Techniques and Applications:** Metabolomics, Proteomics, protein-protein interactions, protein-metabolite interactions; Emerging techniques and their applications in Agriculture and Human Health, Genome editing technologies.	CLO4

Suggested reading:
Research papers and reviews published in peer-reviewed international journals in the above areas.

L	T	P	Credits
2	0	0	2

BCH.751: Research and Publication Ethics

Learning Outcomes: Students will be able to:
CLO1: Familiarize with the ethics of research.
CLO2: Illustrate the good practices to be followed in research and publication.
CLO3: Judge the misconduct, fraud and plagiarism in research.
CLO4: Utilize various online resources and software to analyze their research output.

Unit/ Hours	Content	Mapping with CLO
I 3 hours	**Philosophy and Ethics** • Introduction to Philosophy: definition, nature and scope, content, branches • Ethics: definition, moral philosophy, nature of moral judgements and reactions	CLO1
II 5 hours	**Scientific Conduct** • 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	CLO1 & CLO2

III 7 hours	**Publication Ethics** 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	**CLO2 & CLO3**
IV 4 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 publication developed by SPPU ● Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer, Journal Suggester etc.	**CLO2**
V 4 hours	**Publication Misconduct** ● 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	**CLO2 & CLO3**
VI 7 hours	**Databases and Research Metrics** ● 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	**CLO4**

Course Title: Teaching Assistantship

Course Code: BCH.752

L	T	P	Credit
0	0	2	1

Learning Outcomes:
          Total Hours: 30

At the end of this skill development course, the scholars shall be able to
CLO1: familiarize themselves with the pedagogical practices of effective classroom delivery and knowledge evaluation system
CLO2: 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 classroom 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 classroom 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 Title: Curriculum, Pedagogy and Evaluation

Course Code: UNI.753

Total Hours: 18

L	T	P	Credit
1	0	0	1

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

Unit/ Hours	Content	Mapping with CLO
I 4 hours	**Bases and Principles of Curriculum** 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
II 4 hours	**Curriculum Development** 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
III 3 hours	**Curriculum and Pedagogy** 1. Conceptual understanding of Pedagogy.	CLO3

	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.	
IV 4 hours	**Learners' Assessment** 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. *Activity: Develop curriculum for a course/programme related to the research scholar's discipline.*	CLO3 & 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-learning-excellence/Pages/Principles-of-a-Flipped-Classroom.aspx

http://leerwegdialoog.nl/wp-content/uploads/2018/06/180621-Article-The-Basic-Principles-of-Dialogue-by-Renate-van-der-Veen-and-Olga-Plokhooij.pdf