

Central University of Punjab



Ph.D. Program in Biochemistry

2021-2022

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	Advanced Biochemistry	4	-	4
BCH.751	Research and Publication Ethics	2	-	2
BCH.752	Teaching Assistantship	-	2	1
UNI.753	Curriculum, Pedagogy and Evaluation	1	-	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:

- Illustrate the basic good practices to be followed in research.
- Formulate the principles of ethics in research which will help them to understand the set of conduct norms applied in science.
- Interpret the ethical issues involved in human, animals and plants research.
- Judge the misconduct, fraud and plagiarism in research.
- Utilize the computer and bioinformatics tools for analyzing and interpreting the data.

Unit-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.

Unit-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 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.

Unit-III

15 hours

Computer Application and Biostatistics: Spreadsheet, Presentation, Image processing and Reference Management software. Internet browsers, World Wide Web: Origin and concepts, internet and its application for quality literature collection and secondary data related to research work. Exploring websites, search engines and Cloud computing. Statistical packages and their applications (Graphpad, Prism, SPSS). Statistical tests: 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.

Unit-IV

15 hours

Bioinformatics: Biological databases (DNA/RNA/Protein; Predicting features of individual residues), Alignment tools, BLAST, FASTA, multiple sequence alignment, Pathway and molecular interactions, Primers designing (degenerative and gene specific primers), Genome projects (human, *Arabidopsis* and other genome projects), NCBI, UCSC and other database searches. *In silico* approaches for drug designing, Virtual and Quantitative Screening, identification of cell types epitopes for vaccine designing.

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.

Course Code: BCH.702

Course Title: Advanced Biochemistry

L	T	P	Credits
4	-	-	4

Learning Outcomes

Students will be able to:

- Analyze and synthesize information published in research journals related to Biochemistry.
- Apply concepts of Biochemistry in their research.

Unit I

15 Hours

Metabolism: Recent advances in amino acid, carbohydrate, lipid and nucleotide metabolism.

Unit II

15 Hours

Biochemical Toxicology: Recent advances in xenobiotics; transportation, metabolic fate, and biotransformation. Application of xenobiotic metabolism in food and disease. Microbial and biochemical modulators of xenobiotics.

Unit 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, Cancers, Neurological diseases, genetic diseases, autoimmune diseases, immune-deficient diseases, infectious diseases)., Disease associated molecular mechanistics and signaling pathways. Disease biomarkers. Stress and disease biology Plant pathologies and remedies.

Unit 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.

Suggested Reading:

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

BCH.751: Research and Publication Ethics

L	T	P	Credits
2	0	0	2

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 Title: TEACHING ASSISTANTSHIP
Course Code: BCH.752

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 Title: CURRICULUM, PEDAGOGY AND EVALUATION
Course Code: UNI.753

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.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>