PONDICHERRY UNIVERSITY
SCHOOL OF LIFE SCIENCES

DEPARTMENT OF BIOCHEMISTRY
&
MOLECULAR BIOLOGY

COURSES OF STUDIES
FOR Ph.D. Part – I
PROGRAMME
In

Biochemistry & Molecular Biology

2025-26 onwards

PONDICHERRY UNIVERSITY

SCHOOL OF LIFE SCIENCES

DEPARTMENT OF BIOCHEMISTRY AND MOLECULAR BIOLOGY

SYLLABUS FOR Ph.D. Part – I

PROGRAMME IN

BIOCHEMISTRY AND MOLECULAR BIOLOGY

2025-26 onwards

COURSE CODE	CONTENT	CREDIT	PAGE NO.
BCMB 901	RESEARCH METHODOLOGY	4	3
BCMB 903	RESEARCH AND PUBLICATION ETHICS	2	5
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BCMB 901- RESEARCH METHODOLOGY

4 Credits

COURSE OBJECTIVES:
To understand the fundamentals of designing a scientific problem and experiments to answer the same.
To demonstrate the ability to analyze, present and interpret scientific data to draw accurate and appropriate conclusions and identify implications and future directions of the research.
To know good laboratory practices, ethical issues in research, intellectual property rights, patents and patentability.

UNIT I: Foundations of Research: **12h**
Identification and formulation of scientific problem: Research Question – Defining aims and objectives – hypothesis generation - Concept of theory, empiricism, deductive and inductive theory – validation and interpretation of data - Characteristics of scientific method – Basic and applied research problems -Research Design: Concept and Importance in Research – Features of a good research design – Exploratory and Descriptive Research Designs – concept, types and uses – Reading and interpretation of research papers, Critical analyses of research problems, Patent search - Use of Encyclopedias, Research Guides, Handbooks and Manuals, Academic Databases etc.- translational approach in research.

UNIT II: Experimental Design: **12h**
Concept of Independent & Dependent variables– concept of positive and negative controls – Quality Controls- Single and Double Blind Studies-Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & its importance
- Qualitative and Quantitative research – Concept of measurement, causality, generalization, replication - Problems in measurement in research – Validity, Reliability and Reproducibility.

UNIT III: Concepts of Statistical Methods: **12h**
Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response -
Characteristics of a good sample - Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample –
Practical considerations in sampling and sample size- Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association - p-value, ANOVA (analysis of variance), cluster analysis – SPSS.

UNIT IV: Interpretation of Data and Presentation skills: **12h**
Data mining and analysis, preparation and interpretation - Layout of a Research Paper and other communications, Journals in Life Sciences, Open Access Journals, Predatory Journals, Impact factor of Journals, When and where to publish? - Oral and written presentations- Document preparation, Excel - Power Point Presentation, Scientific editing tools - Hand-outs and Brochures, Paper, Abstract and grant writing skills, Thesis writing - Reference Management and Plagiarism detection softwares.

UNIT V: Good Laboratory Practices, Ethical Issues & IPR: **12h**
Good Laboratory Practices – Data management in laboratory – Regulations for recombinant DNA and toxic compounds research - safety and bio- and radio- hazards, disposal of biological and chemical waste, Accuracy of liquid transfer, Preparation of reagents, chemicals and buffers, Handling

of sophisticated instruments- Animal handling and ethics, Maintenance of animals, Various routes of injections and sample collection, CPCSEA guidelines; Institutional ethics and safety committees, Ethical consideration in research on human beings, Regulation of clinical trials and transfer of biological samples - Copyright, Royalty, Intellectual property rights and Patent laws, Reproduction of published material, Ethical issues related to publishing, Plagiarism and Self-Plagiarism, Citation and acknowledgements, Reproducibility and accountability, Conflict of Interest - IPR-related issues, trademarks, copy rights, patents, geographical indicators.

References:
1. Gall, M.D., Gall, J.P. Borg, W.R. (2006) Educational research: An introduction, Pearson, London.
2. Willis, J. (2004) Data Analysis and Presentation Skills: An Introduction for the Life and Medical Sciences, Wiley, New Jersey.
3. Green. R.H. (1979) Sampling Design and Statistical Methods for Environmental Biologists. John Wiley & Sons, New Jersey.
4. Ruxton, G.D. and Colegrave, N. (2017) Experimental design for the life sciences, Oxford University Press, Oxford.
5. Snedecor, G.W. and Cochran, W.G. (1989) Statistical methods, Iowa State Press, Iowa.
6. Mitchell, K. and Glover, T. (2001) Introduction to Biostatistics, McGraw-Hill Publishing Co., New York.
7. Padma, N. (2017) An Introduction to Ethical, Safety and Intellectual Property Rights Issues in Biotechnology, Academic Press, Cambridge.
8. Shomini, P. and Deepa, G. (2013) IPR, Biosafety and Bioethics, Pearson, London.
9. Bouchoux, D.E. (2013) Intellectual Property Rights: The Law of Trademarks, Copyrights, Patents and Trade Secrets, Cenage Learning, Boston, Massachusetts.

Suggested reading:
1. Ministry of Environment, Forest and Climate Change, Govt. of India (2018) Compendium of CPCSEA.
2. ICMR. (2008) Guidelines for Good Clinical Laboratory Practices (GCLP).
3. ICMR (2017) National Ethical Guidelines For Biomedical and Health Research Involving Human Participants. (https://www.icmr.nic.in/guidelines).

COURSE OUTCOME:
Demonstrate intellectual independence, knowledge about good research practice and ability to make scientific judgments based on such principles.
Have better understanding of the nature of science and values at stake in the practice of science.

BCMB 903 – Research and Publication Ethics

2   Credits

COURSE OBJECTIVES:

This course has total 6 units focusing on basics of philosophy of science and ethics, research integrity, publication ethics. Hands-on-sessions are designed to identify research misconduct and predatory publications. Indexing and citation databases, open access publications, research metrics (citations, li-index, Impact Factor, etc.) and plagiarism tools will be introduced in this course.

THEORY

Unit I: PHILOSOPHY AND ETHICS (3 hrs.)

1. Introduction to philosophy: definition, nature and scope, concept, branches
2. Ethics: ‹lefinition, moral philosophy, nature of moral judgements and reactions

Unit II: SCIENTIFICCONDUCT (5 hrs.)

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

Unit III: PUBLICATION ETHICS (7 hrs.)

8. Publication ethics: definition, introduction and importance
9. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
10. Conflicts of interest
11. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
12. Violation of publication ethics, authorship and contributorship
13. Identification of publication misconduct, complaints and appeals
14. Predatory publishers and journals

PRACTICAL

Unit IV: OPEN ACCESS PUBLISHING (4 hrs.)

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

Unit V: PUBLICATION MISCONDUCT (4hrs.)

A. Group Discussions (2 hrs.)
1. Subject specific ethical issues, FFP, authorship
2. Conflicts of interest

3. Complaints and appeals: examples and fraud from India and abroad
B. Software **tools (2 hrs.)**

   Use of plagiarism software like Tumitin, Urkund and other open source software tools

Unit VI**: DATABASES AND RESEARCH METRICS (7hrs.)**

A. Databases (4 hrs.)
1. Indexing databases
2. Citation databases: Web of Science, Scopus, etc.

B. Research Metrics (3 hrs.)
l. Impact FaCtof of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score
 2. Metrics: h-index, g index, i10 index, altmetrics

References

1. Bird, A. (2006). *Philosophy ofscience*. Routledge.
2. MacIntyre, Alasdair (1967)'A *Short Hi.sior)• of Ethics.* London.
3. P. Chaddali, (20 18) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978- 9387480865
4. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). *On Being a Sciunfisl: A Guide to Responsible Conduct in Re.search: Third edition.* National Academies Press.
5. Resnik, D. B. (201 l). What is ethics in research & why is it important. *National Institute of Envii ontnemal Health Sciences, I—10.* Retrieved from https://ww w.niehs.nity. Nov/research/resourcesfbioethics/whatis/index.cfm
6. Bcall, J. (2012). Predatory publishers are comipting open access. Nature, 489(7415), 179—179. https://doi.org/10.1038/489179a
7. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN:978-8 1-939482- 1-7. htto://www.insaindio res.in/rdf/Ethics Book.pdf

COURSE OUTCOME: _At the end of the course the students would have learnt the basics of philosophy of science and ethics, research integrity, publication ethics and would have gained capabilities of identifying research misconduct using plagiarism tools and predatory publications. Students will also be able to appreciate the value of Indexed publications and citation databases, open access publications, research metrics as citations, li-index, Impact Factor, etc. which will motivate them towards ethical publications with good impact._

LIST OF OPTIONAL SWAYAM COURESES

COURSE OBJECTIVES:
To allow the student to get knowledge support in allied fields related to the fundamentals of their broad research area for individual student and to enable them choose their essential knowledge domain and develop research area specific state of the art knowledge associated to their research question.

COURSE SELECTION
The respective research supervisor along with the Doctoral Committee will help the PhD student choose the right course to meet their specific knowledge requirements of the research area.
The available options are -

COURSE CODE	COURSE TITLE	CREDITS
OBCMB07	**Drug Delivery Principles and Engineering**	**2**
OBCMB10	**Experimental Biotechnology**	**2**
OBCMB11	**Cell Culture Technologies**	**2**
OBCMB12	**Basic Course in Biomedical Research**	**2**
OBCMB13	**Organic Chemistry in Biology and Drug Development**	**2**

COURSE OUTCOME:
Upon completion of the course the student would demonstrate updated knowledge in the allied area specific to their field and state of the art knowledge in these domains critical to their specific research question.

BCMB 9XX – (GUIDE PAPER)

4 Credits

COURSE OBJECTIVES:
To understand the fundamentals of the broad research area for individual student and to develop research area specific state of the art knowledge associated to their research question.

The syllabus content shall be determined by the respective research supervisor, tailored to meet the specific knowledge requirements of the research area. The proposed syllabus must be reviewed and approved by the Doctoral Committee during its meeting.

COURSE OUTCOME:
Upon completion of the course the student would demonstrate updated knowledge in the broad area specific to their field and state of the art knowledge critical to their specific research question.