

Structure and Details of PhD coursework Syllabus

Department of Life Sciences

Presidency University

(To be implemented from Academic session 2022-23)



**PRESIDENCY
UNIVERSITY**
K O L K A T A

Department of Life Sciences

(Faculty of Natural and Mathematical Sciences)

Presidency University

Hindoo College (1817-1855), Presidency College (1855-2010)

86/1, College Street, Kolkata - 700 073

West Bengal, India

PhD Coursework (Department of Life Sciences)

Introduction

The Department of Life Sciences is a dynamic department boasting of faculty specializing from almost all aspects of the division of Life Sciences. Research in the Department is varied and cross-disciplined ranging from crop biotechnology, ecology, structural biology, microbiology, virology, cancer biology, development biology, toxicology and much more. The PhD Coursework is a mandatory part of the PhD curriculum and is expected to be completed within the first year of enrollment, latest within the first TWO years of enrollment into the PhD program. Exemption from the coursework is allowed in special cases as per the regulations of the University. The syllabus offers a range of topics in accordance with the UGC guidelines. The course offers generalized knowledge such as ethical practices, statistics and bioinformatics as well as specialized training to the students' research areas. Exposure and training of common instruments are also integrated into the coursework. The course also integrates elements of writing and presentation to introduce the student to all aspects involved in a research career.

Aims and Objectives:

The PhD Coursework aims the following:

1. Orientation of the student to a career in research.
2. Introduction to hypothesis development and planning.
3. Understanding of ethical and safety considerations in use and handling of equipment, reagents and research models.
4. Understanding of data compilation and handling.
5. Exposure to recent and updated techniques in data analysis and handling.
6. Understanding and implementing good laboratory practice.
7. Understanding of ethical practice in research, data management, publishing ethics.
8. Understanding critical reading of research articles, understanding how experiments are designed to test a hypothesis. Understanding the importance of alternative strategies.
9. Introduction and basic training to common instrument facilities of the department.
10. Developing writing and presentation skills.
11. Developing a hypothesis and preparing a project.

Program Structure:

The PhD coursework is of 16 credits and is taught and evaluated over a period of 16 weeks. The course consists of 5 papers, of which three are non-sessional papers and two sessional. All papers will mandatorily be studied by all students enrolled in the coursework. In BIOS C3, students will be divided up into groups with similar research interests. The evaluation of all non-sessional papers will be based on continuous evaluations held throughout the course as well as end-semester written examinations. Continuous evaluations will consist of a combination of assignments, quizzes, writeups, and presentations taken by multiple teachers involved in the course. The end semester examination will be a written examination based on all topics covered during the course. The sessional papers will be based completely on continuous evaluations via methods mentioned above. Details of evaluation of each paper is given along with it.

A student needs to score a minimum CGPA of 6.00 in the coursework in order to continue in the PhD program. Moreover he/ she needs to score a minimum of B grade (55 to <60 percent marks) in each individual course.

Paper Code	Name of Paper	Full Marks	Credits
BIOS C1	Research Methodology and computer applications	50 marks	4
BIOS C2	Research and Publication Ethics	25 marks	2
BIOS C3	Critical Analysis of Scientific Literature	35 marks	3
BIOS C4	Care and Use of Common Laboratory Equipment/ Facilities	50 marks	4
BIOS C5	Writing and Presentation Skills	40 marks	3

Course runs for 16 weeks

Detailed Syllabus

BIOS C1: Research Methodology

Non-sessional Paper, 50 marks, 4 credits

(a) Hypothesis Development and formulating a research question:

(i) Paradigms in science in general and in life sciences. Definition of Paradigm, Definition of normal science VS Paradigms. View of some of the philosophers of Science. (ii) Defining a problem, survey of available literature, formulating a hypothesis. Developing objectives to test the hypothesis, study design, importance of controls, data collection, developing a timeline of study. (iii) Concepts of intellectual property. (iv) Developing entrepreneurship.

(b) Biosafety considerations, good laboratory practices and ethical issues:

(i) Ethical use of animal subjects; (ii) Ethical use of human subjects; (iii) Stem cell ethics; (iv) Ecological, ethical and human safety issues related to transgenic crops; (v) Agricultural ethics; (vi) Eco-sourcing: code of practice; (vii) Radioactive, chemical and biohazard safety, waste management and disposal. (viii) data management and maintenance of laboratory notebooks.

(c) Statistical Methods and data analysis:

(i) Numerical and graphical presentation of data; (ii) Measures of central tendency; (iii) Measures of dispersion; (iv) Testing of significance of hypothesis by student's t-test, paired t-test and Fisher's t-test; (v) Determination of correlation coefficient between two variables; (vi) Regression analysis of bivariate data using statistical software; (vii) Theories of probability; (viii) Analysis of variance; (ix) Post-hoc test; (x) Statistical distributions (Normal, binomial and Poisson distributions); (xi) Basic statistical modeling; (xii) Data presentation and handling in Excel; Statistical analysis using SPSS/ statistical software (xiii) image processing and calculations using Image J. (xiv) Use of various analytical techniques such as microarray and real-time PCR data analysis, (xv) use of R software, analysis of data from GEO datasets. (xvi) Next gen sequencing data analysis, (xvii) Concept of data normalization and transformation

(d) Applications of Bioinformatics:

(i) Introduction to Bioinformatics; (ii) Bioinformatics data types; (iii) Sequence formats (e.g. raw text, FASTA, Stockholm); (iv) Sequence and structure databases (e.g. Genbank, PDB etc.); Important genome databases, (v) Sequence alignments - pairwise and multiple; (vi) Basic Bioinformatics tools (BLAST, CLUSTALW etc.); (vii) Molecular visualization using Rasmol, (viii) Phylogenetic tree generation and analysis (viii) Basics of in silico docking analysis and simulation studies.

Assessment Method: Evaluation will be conducted through multiple continuous assessment/ assignments (25 marks) and final written examination (25 marks).

BIOS C2: Research & Publication Ethics

Non-Sessional Paper, 25 marks, 2 credits

(a) Philosophy and Ethics:

(i) Introduction to philosophy: definition, nature and scope, concept, branches; (ii) Ethics: definition, moral philosophy, nature of moral judgements and reactions

(b) Scientific Conduct:

(i) Ethics with respect to science and research; (ii) Intellectual honesty and research integrity; (iii) Scientific misconducts: falsification, fabrication and plagiarism (FFP); (iv) Redundant publications: duplicate and overlapping publications, salami slicing; (v) Selective reporting and misrepresentation of data, falsification of images

(c) Publication Ethics:

(i) Definition, introduction and importance of publication ethics; (ii) Best practices/standards setting initiatives and guidelines: COPE, WAME, etc. (iii) Conflicts of interest; (iv) Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types; (v) Violation of publication ethics, authorship and contributorship; (vi) Identification of publication misconduct, complaints and appeals; (vii) Predatory publishers and journals

(d) Open Access Publishing:

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

(e) Publication Misconduct:

Group discussions on - (i) Subject specific ethical issues, FFP, authorship; (ii) Conflicts of interest; (iii) Complaints and appeals: examples and fraud from India and abroad; Using Software tools - (iv) Anti-plagiarism tools like Turnitin, Urkund and other open source software tools

(f) Databases and Research Metrics:

(i) Databases - Indexing databases, Citation databases: Web of Science, Scopus etc.; (ii) Research Metrics - Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score, h-index, g index, i10 index, altmetrics; (iii) Citation of bibliography using Mendeley

Assessment Method: Evaluation will be conducted through continuous assessments based on group discussions, assignments, quizzes (10 marks) and final written examination (15 marks).

BIOS C3: Critical Analysis of Scientific Literature

Non-sessional paper, 35 marks, 3 credits

Students will be exposed to critical reading of research articles where group discussions will be held on at least three journal articles related to the general field of research. Each group will be taught by the proposed supervisor and at least two faculty members with similar research interests.

Discussion will involve critical analysis of the paper's emphasis on the objective/hypothesis in question, how experiments have been designed to answer the questions, interpretation of the results and alternative methods that could have been used.

Assessment Method: A formal written open-book examination will be taken based on critical analysis of the discussed research articles (25 marks). Internal assessment will be based on the presentation of a research paper in the Departmental seminar series (10 marks).

BIOS C4: Care and Use of Common Laboratory Equipment/ Facilities

Sessional Paper, 50 marks, 4 credits

This will be a sessional paper based on continuous evaluation. It will be conducted by the facility/ instrument in charge. This will include a theoretical background followed by hands-on training. The following instruments/ facilities may be covered.

- a) Centrifuges- Refrigerated and Ultracentrifuge
- b) Microscopes
- c) Histomorphometry
- d) Animal and Plant cell culture
- e) Animal handling and Aquaculture
- f) Gel Doc/ Chemidoc
- g) Real time PCR
- h) Spectroscopy including Nanodrop
- i) Chromatography
- j) Sterilization techniques
- k) Basic molecular biology techniques
- l) ELISA/ Multi mode Reader
- m) 2-D Gel Electrophoresis
- n) GC-MS

o) Atomic absorption spectroscopy

Assessment Method: Evaluation will be compiled from individual assessments/ quizzes taken by the faculty members upon demonstration of a technique. It will be based on continuous evaluation held throughout the course.

BIOS C5: Writing and Presentation Skills

(Sessional Paper, 40 marks, 3 credits)

(a) **Writing a review of the literature related to the research problem.** This will be followed by presentation and defense of the review.

(b) **Writing a project proposal- and defense.** A project needs to be written and submitted by the student. The format for the project will be that of start-up grants of UGC/ DST.

Assessment Method: Evaluation will be done by the proposed supervisor along with at least two other faculty members. Marks breakup is as follows:

For review (20 marks): Submission of review- 10 marks, Presentation- 5 marks, Defense- 5 marks

For project proposal (20 marks): Submission of grant- 10 marks, Presentation- 5 marks, Defense-5 marks

Suggested reading:

Statistics in Biology and psychology- Debajyoti Das and Arati Das

On being a scientist- A guide to responsible conduct in research-The National Academic Press

Regulations and Guidelines for recombinant DNA research and Biocontainment- Department of Biotechnology, Ministry of Science and Technology.

National Ethical Guidelines for Biomedical and health research involving Human Participants-ICMR.