# Institute of Health Sciences, Presidency University

## Syllabus for Ph.D. coursework

- Duration of Coursework: 1 semester (Even semester)
- Coursework examination- Even semester (regular)
- Examination of backlog paper(s)- Subsequent semester
- All the papers are compulsory for the fulfillment of the coursework

| Course Code | Title | Classification | Credit | Marks |
|---|---|---|---|---|
| BITGC1 | Research methodologies in biotechnology | Non-sessional | 4 | 50 |
| BITGC2 | Research and Publication Ethics | Sessional | 2 | 25 |
| BITGC3 | Emerging areas of biotechnology | Non-Sessional | 4 | 50 |
| BITGC4 | Scientific writing | Sessional | 2 | 25 |
| BITGC5 | Journal presentation | Sessional | 2 | 25 |
| BITGC6 | Training on the operation and maintenance of the sophisticated instruments at IHS | Sessional | 2 | 25 |
| | **Total credit and marks:** | | 16 | 200 |

**BITGC1: Research methodologies in biotechnology** **64 h**

Unit I: Objective of Scientific Research

Meaning, objectives and motivations in scientific research, Characteristics and limitations of research. Components of research work - criteria of good research. Types of Research- Fundamental, Theoretical Research, Applied Research, Descriptive Research, Evaluation Research, Experimental Research, Survey Research, Qualitative Research, Quantitative Research. Problems Encountered by Researchers in India.

Unit II: Research Design

Research Design – definition, essentials and types of research design, errors and types of errors in research design. Research problem: Selecting and analyzing the research problem, problem statement formulation-formulation of hypothesis.

Literature review: purpose, sources, and importance; literature review procedure. Objectives- learning objectives; Formulation of the research objectives.

Unit III: Measurement, Scaling and Sampling

Variables in Research- Measurement and scaling, Different scales. Data Collection methods- primary and secondary data – Construction of questionnaire. Construction of instrument – validity and reliability of instrument. Sample size determination.

Unit IV: Data Analysis and Tools

Processing of Data: Editing of Data, Coding of Data, Classification of Data –Statistical Series. Qualitative vs Quantitative data analyses – Univariate, Bivariate and Multivariate statistical techniques.

Practice of statistical methods in biology; samples and populations; Data collection and graphical representation; Measures of Central Tendency- mean, median. Probability; Populations and samples.

Measures of dispersion- range, mean deviation, coefficient of variation; standard deviation, standard error; confidence interval; Tests of statistical significance by student's t-test, Mann-Whitney test, paired t-test and Fisher's t-test, One Way ANOVA, Two Way ANOVA, Repetitive Measure test; Survival test (Kaplan-Meier and Log rank Mantel-Cox Test

Correlation and Regression (Pearson and Spearman's Rank Correlation), Chi-square test: Applications, Steps, characteristics, limitations, Analysis of Variance and Covariance, Factor analysis – Discriminant analysis-cluster analysis-multiple regression and correlation-multidimensional scaling. Application of statistical software for data analysis. Data analysis using various software such as SPSS, Graphpad Prism.

Unit V: Research Report

Writing Research report- types and contents of report, executive summary. Contents of chapter, report writing, the role of audience, readability, comprehension, final proof, report format

Unit VI: Intellectual Property Rights (IPR)

Concept and provisions of IPR. Intellectual Property System in India. Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organization (WIPO). Paris Convention for the Protection of Industrial Property, Duration of Protection, Trade Related Aspects of Intellectual Property Rights (TRIPS). Patents, Trademarks, Copyright, Conditional information, Breeder's right. Patent-types, scope, criteria, applying for a patent. Protection of Biotechnological invention. Operational aspects – calibration, accuracy checks of quality control; FDA and EPA regulations for clinical use of DNA tests and commercial release of chemical products.

Unit VII: Biosafety

Biosafety consideration for research. Biosafety level categories. Introduction to institutional biosafety committee, animal ethics committee and human ethics committee and their purpose

Handling of genetically modified organisms; Handling of laboratory chemical waste

Safety measurement for radioactive material used in biological systems.

**BITGC2: Research and Publication Ethics** **32 h**

Philosophy and Ethics

Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: definition, moral philosophy, nature of moral judgment and reactions

Scientific conduct

Ethics with respect to science and research; Intellectual honesty and research integrity. Scientific misconducts: falsification, fabrication, and plagiarism. Redundant publications: duplication and overlapping publications, salami slicing. Selective reporting and misinterpretation of data

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 behavior and vice versa
Violation of publication ethics, authorship and contributorship. Identification of publication misconduct, complaints and appeals; Predatory publishers and journals

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

Group discussion on Subject specific ethical issues, FFP, authorship; Conflicts of interest; Complaints and appeals: examples and fraud from India and abroad
Hands on training to use of plagiarism software like Turnitin, Urkund and other open-source software tools

Databases and research matrices

Analyzing various Databases-Indexing databases; Citation databases: Web of Science, Scopus etc
Use of Software tools to analyze Impact Factor of journal as per journal citation report, SNIP, SJR, IPP, Citescore; Analyzing Metrices- h-index, g index, i10 index, altmetrics

**BITGC3: Emerging areas of biotechnology 64 h**

Section A: Application of Bioinformatics

Biological Databases: Application of Sequence, Pathway, and Structural databases for research; Tools for efficient database search and data retrieval.
Sequence Analysis and Alignment: Applications of sequence homology and similarity in genomics and proteomics; Hands-on experience with pairwise sequence alignment using tools like BLAST; Use of scoring matrices, gap penalties, and statistical significance in sequence alignment; Case study: Using multiple sequence alignment for evolutionary analysis.
Phylogenetics: Construction of phylogenetic trees using distance-based and character-based methods; Real-world examples of phylogenetic analysis in tracing evolutionary history and species classification.
Protein Structure and Functional Applications: Identification of protein profiles, motifs, and domains for functional prediction; Case study: Application of homology modeling to predict protein structure and interaction sites.

Section B: Emerging areas of biotechnology

Each student will select two papers for advanced studies in biotechnology and health sciences from the following options:
BITGC3-B1: Clinical Immunology
BITGC3-B2: Nucleic acid biology and Epigenetics in diseases
BITGC3-B3: Neurobiology of diseases
BITGC3-B4: Cell biology of human diseases
BITGC3-B5: Genomics and Transcriptomics
BITGC3-B6: Molecular Virology

BITGC3-B7: Agricultural Biotechnology
BITGC3-B8: Biomaterials
BITGC3-B9: Nanobiotechnology
BITGC3-B10: Synthetic and Medicinal chemistry
BITGC3-B11: Molecular endocrinology and Endocrinopathies
BITGC3-B12: Biology of parasitic diseases

**BITGC4: Scientific writing** **32 h**

Each student will prepare a grant proposal in a prescribed format. Instructor will mentor the preparation, the use of reference software and anti-plagiarism software. The proposal and a presentation defending the proposal will be assessed by a committee of three faculty members.

**BITGC5: Journal presentation** **32 h**

**E**ach student will present one or two recent (not older than 3 years) research articles and will participate in the discussion during the departmental journal club. Assessment will be done continuously.

**BITGC6: Training on the operation and maintenance of the sophisticated instruments at IHS** **32 h**

Hands on training on operation, application, process design, care and maintenance of all the sophisticated instruments will be provided by the experts. Assessment will be done continuously.