**CHAITANYA (DEEMED TO BE UNIVERSITY)**

**Pre-Ph.D. (Biochemistry)**

**Paper-I**

**Research and Publication Ethics**

Hours per week: 02 Credits: 02

**UNIT-I:**

1. Philosophy and Ethics: Introduction to Philosophy – definition – nature and scope – concept – branches – Ethics: definition – moral philosophy – nature of moral judgments and reactions.
2. Scientific Conduct: Ethics with respect to science and research – Intellectual honesty and research integrity – scientific misconducts: Falsification – Fabrication and Plagiarism – Redundant publications: Duplicate and overlapping publications – salami slicing – Selective reporting and misrepresentation of data.
3. 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 – types – Violation of publication ethics – authorship and contributorship – Identification of publication misconduct – complaints and appeals – Predatory publishers and journals.

**UNIT – II:**

1. Open Access Publishing: Open access publications and initiatives – SHERPA / RoMEO online resource to check publisher copyright & self–archiving policies – A software tool to identify predatory publications developed by SPPU – Journal finder/journal suggestion tools viz., JANE, Elsevier journal finder, Springer journal suggester, etc.
2. Publication Misconduct:
3. Group Discussions: Subject specific ethical issues - Falsification – Fabrication and Plagiarism (FFP), authorship – Conflicts of interest- Complaints and appeals : examples and fraud from India and abroad.
4. Software tools: Use of plagiarism software like Turnitin, Urkund and other open-source software tools.
5. Databases and Research Metrics:
6. Databases: Indexing databases – Citation databases: Web of Science, Scopus, etc.
7. Research Metrics: Impact factor of journal as per journal citation report, SNIP, SJR, IPP, and Cite Score – Metrics: h – index, g index, i10 index, altmetrics.

**References:**

1. Bird, A. (2006). Philosophy of Science. Routledge.
2. MacIntyre, Alasdair (1967) A Short History of Ethics, London.
3. P.Chaddah, (2018) Ethics in Competitive Research: Do not get scooped: do not get plagiarized, ISBN: 978-9387480865.
4. National Academy of Science, National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guide to responsible Conduct in Research: Third Edition. National Academy Press.
5. Resnik, D.B. (2011). What is ethics in research & why is it important, National Institute of Environmental Health Sciences, 1-10. Retrieved from <https://www.niehs.nih.gov/research/resoureses/bioethics/whatis/index.cfm>.
6. Bcall, J. (2012). Predatory publishers are corrupting 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: 978-81-939482-1-7, https://www.insaindia.res.in/pdf/Ethics\_Book.pdf.

**CHAITANYA (DEEMED TO BE UNIVERSITY)**

**Pre-Ph.D. (Biochemistry)**

**Paper-II**

**Research Methodology**

Hours per week: 04 Credits: 04

**U NIT-I: Research Problem and Design**

1. Introduction to Research Methodology: Meaning of Research, Objectives of Research, Motivations in Research, types of Research, Research Approaches, Significance of Research, Research Methods v/s Methodology, Research and Scientific Methods, Research Process, Criteria of Good Research.
2. Defining the Research Problem: Concept and need, Identification of Research problem, defining and delimiting Research problem.
3. Research Questions and Hypothesis: Variables and their linkages, characteristics of good Hypothesis. Research question and formulation of hypotheses-directional and non-directional hypotheses, Basis for hypotheses.
4. Research design: Meaning, Need, Features of Good Design, Concepts, Types. Basic principles of Experimental Design, various methods of Research. The survey, Philosophical, Historical, Experimental, Causal Comparative, Genetic, and Case Studies.

**UNIT-II: Literature Searching and Report Writing:**

1. Tools for Data Collection: Collections of Primary Data, Collection of Data through questionnaire and Schedules, other Observation Interview Methods, Collection of Secondary Data, Selection of appropriate method for data collection, Case Study, Focus Group Discussion.
2. Techniques of developing research tools, viz. Questionnaire and rating scales etc. Reliability and validity of Research tools.
3. Writing Research Report: Format and style, Review of related literature its implications at various stages of research. (Formulation of research problem, hypothesis, interpretation and discussion of results).
4. Major findings, Conclusions and suggestions. Citation of references and bibliography.

**UNIT-III: Statistical Analysis & Bioinformatics**

1. Data collection: Sources of Data: Primary Data, Secondary Data; Sampling Merits and Demerits of Experiments, Procedure and Control Observations, Sampling Errors - Type-I, Error - Type-II Error. Statistical analysis and fitting of data.
2. Probability Theories - Conditional Probability, Poisson Distribution, Binomial Distribution and Properties of Normal Distributions, Estimates of Means and Proportions; Chi-Square Test, Association of Attributes, t-Test. Standard deviation - Coefficient of variations. Correlation and Regression Analysis. Introduction to statistical packages, plotting of graphs.
3. Development of bioinformatics, Operating systems in bioinformatics. Databases: Gene banks, Sequence and structure databases; types of databases, web interfaces; Search tools: Data mining, BLAST and FASTA. Sequence analysis of biological data. Major bioinformatics resources (NCBI, EBI, ExPASy).Phylogenetic analysis:
4. Concept of phylogenetic trees, phylogenetic trees and multiple alignment methods, suitable software-EMBOSS. Approaches methods and function of gene prediction,

**UNIT-IV: Analytical Techniques**

1. Spectroscopy: Principles of spectroscopy: Laws governing light absorption (Beer-Lambert's Law). Instrumentation and biological applications of UV and visible spectrophotometer. Flamephotometry, atomic-absorption spectrophotometry, Basic principles of IR and NMR spectroscopy. Radioisotope techniques; types of isotopes. Nature and type of radioactivity, Decay units, detection and measurement of radioactivity (GM and Scintillation). Biological uses of radioisotopes.
2. Separation techniques: Principles, methods and biological applications various chromatography techniques. Basic principles and applications of different electrophoresis methods. Principles and applications of various centrifugation techniques.
3. Microscopy: principles and working of light and phase-contrast, fluorescent, scanning and transmission electron-microscopy.
4. Flowcytometry and their applications.

## Reference Books:

1. Best and Kahn, Research Methodology, PHI Limited.
2. Kothari, C.R. Research Methodology (Methods and Techniques), New Age Publisher.
3. Kerlinger, Foundation of Research.
4. Fundamentals of modern statistical methods by Rand R.wilcox.
5. Power Analysis for Experimental research A Practical Guide for the Biological, Medical and social Sciences by R. Barker Bausell, Yi-Fang Li Cambridge University Press.
6. Design of Experience: Statistical Principles of Research Design and Analysis, by Robert O. Kuehl Brooks/cole.

**CHAITANYA (DEEMED TO BE UNIVERSITY)**

**Pre-Ph.D. (Biochemistry)**

**Paper-III**

 **Trends & Tools in Biochemistry Research**

Hours per week: 04 Credits: 04

**Unit I:**

**Enzyme Engineering & Recombinant DNA technology:** Cell culture techniques. Hybrid proteins. Site-directed mutagenesis approaches to improve industrial enzymes. Isolation and purification of nucleic acids; amplification of DNA using PCR, recombinant PCR, nested PCR, use of restriction and modification in enzymes in cloning, plasmid vectors, λ phage, DNA sequencing, next generation sequencing, Principle and applications of blotting techniques.

**Unit-II**

**Bioinformatics:** Development of bioinformatics, Operating systems in bioinformatics. Databases: Gene banks, Sequence, and structure databases; types of databases, web interfaces; Search tools: Data mining, BLAST, and FASTA. Sequence analysis of biological data. Major bioinformatics resources (NCBI, EBI, EXPASY). Phylogenetic analysis: Concept of phylogenetic trees, phylogenetic trees, and multiple alignment methods, suitable software EMBOSS. Approaches methods and function of gene prediction

**Unit III:**

**Chromatography & Electrophoretic Techniques:** Chromatographic methods for macromolecule separation - Gel permeation, Ion exchange, Affinity chromatography; HPLC and FPLC. Theory and application of Polyacrylamide and Agarose gel electrophoresis; Capillary electrophoresis; 2D Electrophoresis; Disc gel electrophoresis; Pulsed-field gel electrophoresis Basic principles of centrifugation techniques.

**Unit IV:**

**Advanced Techniques:** MALDI-TOF; Mass spectrometry; Enzyme and cell immobilization techniques; Peptide Synthesis and Sequencing.

**Books recommended:**

1. Voet D., Voet J.G, Biochemistry 4 th Edition., John Wiley and Sons, 2011.

2. Nelson, D. C. And Cox, M.M., Lehninger Principles of Biochemistry, 5thEdition,W. H. Freeman,

 2010.

3. Berg J.M., Tymoczko J.L. and Stryer L., Biochemistry. 7th edition, W.H. Freeman and Co. New

 York, 2011.

4. Molecular biology by Robert F. Weaver McGraw-Hill 4 edition (2007)

5. Advanced molecular biology by R. M. Twyman, (1998)

6. Genes VII by B. Lewin Oxford University Press, Cell Press, London (2000)

7. Arora .P, Mani and Vijayaraj Bioinformatics for the beginners.

8. Rastogi. Bioinformatics Basic skills and applications

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**Pre-Ph.D. (Biochemistry)**

**Paper-IV**

Analysis of Published research papers / scientific literature

Hours per week: 02 Credits: 02

A research scholar should submit an analysis of published research papers / scientific literature in the form of a dissertation.