



दक्षिण बिहार केन्द्रीय विश्वविद्यालय
CENTRAL UNIVERSITY OF SOUTH BIHAR
SH-7, Gaya- Panchanpur Road, Village- Karhara, Post- Fatehpur
P.S- Tekari, District- Gaya (Bihar) PIN- 824236

Department of Bioinformatics

Course Curriculum for Ph.D (Bioinformatics)

There will be 12 credit courses (two semesters) for a Ph.D student.

One Semester

Course Code	Courses	Credits
*** 901	Research Methodology	4
*** 902	Tools and Techniques of Research in Bioinformatics	4
*** 903	Preparation and Presentation of Research Proposal	4
Total Credits		12

901 Research Methodology (4 Credits)

Course objectives: This course is designed to provide an overview on fundamentals of doing research including scientific terminology, literature, methods, analysis and interpretation of data, preparation of research report and presentation, future aspects of research as a career, importance and applications of scientific research to the society. It will help the students to develop core research skills relevant to a wide spectrum of biological research particularly in bioinformatics, including written and oral communication, skills in making scientific observations, and recording and analysing data by participating in discussions or through presentations or group research project associated with a discipline of interest to them. Assignments and tutorials would be included to enhance the course deliver and outcome.

Unit 1 and 2 is common for CUSB PhD students

Unit 1: Research: A Conceptual Frame work

- Research: meaning and concept
- Knowledge, facts, principles, theories and research as source of knowledge
- Scientific method of inquiry and basic steps of research
- Types of research: Basic Applied and Action Research
- Ethics in Research
- Methods and Methodology
- Intellectual Property Rights

Unit 2: Computer Applications

- Word Processing, Data processing, Graphical Processing, use of Web tools for Research, use of multimedia tools

Unit 3 and 4 is department specific

Unit 3: Scientific Methodology and Biostatistics

Rules and Principles of Scientific Method, Hypothesis and Testing a Hypothesis, Data Collection and Analysis/Sampling Theory, Interpretation of Results and Generalization, Descriptive Statistics, Random Variable, Distribution of Random Variables, Binomial and Normal Distribution, Non Parametric Tests, Correlation And Regression, Linear Programming.

Unit 4: Biological Research in Practice and Scientific Writing/ Presentation

Types of Scholarly Scientific content, Selection process of scientific content, Bibliometrics, scientometrics, webometrics and altmetrics, Journal indexing, Indexing databases for research articles and abstracts, various citation indices and matrices, h-index and i₁₀-index, Basics of writing an article in scholarly journals, Contents & order of a regular journal article, Thesis writing, poster presentation, Art of and use of visuals for oral presentation, Writing style and various presentation tools, writing Research Proposal for Funding scientific projects, Reviewing papers and presentations.

Suggested Readings

- C R Kothari, Research Methodology: Methods and Techniques
- Khanal Arun , Bhadra Mahajan S Methods In Biostatistics For Medical Students And Research Workers
- Ronald B. Corley, A Guide To Methods In The Biomedical Sciences
- Successful Scientific Writing – Guide for biological and medical science writing by Robert W. Matthews, John M. Bowen, Janice R. Matthews, Cambridge University Press, 1996

902 Tools and Techniques of Research in bioinformatics (4 Credits)

Course objectives: This course is designed to teach basic concept, principle and application of various instruments/tools/techniques commonly used to conduct experiments in bioinformatics. This course includes familiarization with general techniques, methods of data analysis and interpretation. This course consists of teachings like good laboratory procedure and practices, standard operating procedures for biological research, legal and institutional framework for biosafety, international agreements and protocols for biosafety.

Unit 1: Relevant Biophysical and Experimental Techniques

Introduction to spectroscopic methods, an overview of UV/VIS Spectrophotometry, IR, Raman, Fluorescence and Mass spectroscopic or related techniques, X-ray crystallography,

NMR and cryoEM methods of structure determination, crystallization techniques, Gel Electrophoresis and Chromatography techniques

Unit 2: Tools & Techniques for Computational Biology-I

Introduction to bioinformatics methods, sequence, structure, pattern and pathways databases and tools, Modelling methods used in drug discovery – Ligand based and structure-based design, biologics design, Macromolecular structure prediction, visualization and analysis, NGS Data analysis, Microarray Data Analysis: Methods

Unit-3: Tools & Techniques for Computational Biology-II

Molecular mechanics, semi empirical and ab initio methods, Advanced simulation techniques- Free-energy perturbation, metadynamics, conformation ensemble approach, An overview of Programming Languages used in Biological Data Analysis, Database design, Scientific workflow systems: Pipeline Pilot and KNIME, Data mining techniques, clustering methods, Brief introduction on machine learning algorithms and Omics technologies, AI in computational biology.

Unit 4: Biosafety, ethics and IPR

Regulatory bodies, practices and compliances, Good Laboratory Practices (GLP), Research Ethics & Misconduct, Patents, Copyrights, GI and Trademarks, Product and process patent, Patent Treaties and Convention, process of filing patent, database of patent, search and retrieval.

Suggested Readings:

1. Biochemical Techniques theory and practice: White R , Waveland Pr Inc, 1990
2. Analytical Chemistry: Gary D. Christian, Purnendu K. Dasgupta, Kevin A. Schug, Wiley
3. A Biologist Guide to Principle and Techniques: Willson K. and Gounding K.H.
4. An Introduction to Practical Biochemistry: Plummer D. T.
5. NMR of Proteins and Nucleic Acids by Kurt Wüthrich, Wiley, 1986
6. Nuclear Magnetic Resonance: Basic Principles By T.I. Atta-Ur-Rahman, Springer Verlag.
7. Crystal Structure Analysis for Chemists and Biologists By Jenny P. Glusker, Mitchell Lewis, Miriam Rossi Wiley-VCH 1994
8. Protein Crystallography (Molecular Biology Series) by T. L. Blundell, Lewis Johnson, Academic press, 1976
9. Crystallization of Biological Macromolecules by Alexander McPherson, Cold Spring Harbor Laboratory Press, 1999
10. Mount DW (2001) Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press
11. Sharma V, Munjal A, Shanker A (2016) A Text Book of Bioinformatics. Rastogi Publications
12. Introduction to Computational Chemistry by Frank Jensen, Wiley-VCH.
13. Free Energy Calculations in Rational Drug Design by M. Rami Reddy, Mark D.

Erion, Springer, 2001

14. Bioethics And Biosafety by M. K. Sateesh (2008)

15. Biosafety Regulations of Asia-Pacific Countries by Kavita Gupta, J. L. Karihaloo and R. K. Ketarpal (2008)

903 Preparation and Presentation of Research Proposal (4 Credits)

Course objectives: This course is designed to prepare the students for the research topic that he/she will take for Ph.D degree. This course consists of review of literature, presentation and finalizing the proposed area of research. The student is required to present periodically before Research Advisory Committee consisting of 2 external faculties along with guide.

Review of Literature, Identifying the Gap Area of Research,
Submission of Research Proposal and Presentation to Research Advisory Committee (PhD student specific) and Department Research Degree Committee (DRDC)

Seminar Course (0 Credits)

One Seminar Course with 0 (zero) credits having "Satisfied" or "Unsatisfied" grade wherein Ph.D. student would choose (with the help of mentor) a **recently published paper from prestigious journals such as Nature, Science etc. and make a presentation during the semester.**

Evaluation of the course: The faculty should evaluate the presentation based on the following criteria: Choice of the paper, Structure and Organization of the talk, Delivery, Questions and Answers and Use of Time and similar other criteria.

Outcome: This course will help the research students in communication, how to read and understand a scientific paper, what important findings should be highlighted in a research paper, what could be the future directions and the weakness (if any) of the paper.