SIDDHARTH UNIVERSITY

Kapilvastu, Siddharth Nagar (UP)- 272202

Course Title: Bioanalytical Techniques

Course Code: ZODC701

Credit Units: 03

Level: **pre-Ph.D. Course Work**

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
3	0	0

Course Objectives:

The Learning Objectives of this course are as follows:

- Develop a fundamental understanding of bioanalytical techniques.
- Learn the principles and working mechanisms of techniques.
- Perform laboratory procedures as per standard protocols in the areas of their specialization.
- Learn use of the tools and techniques for research in their specific area of interest.
- Develop the ability to analyze data obtained from various bioanalytical methods, present findings graphically, and derive scientific conclusions.

Pre-requisites:

- Post Graduation or 4 years Graduate with Research.
- Students enrolling in this course should have a foundational understanding of the Biology, basic analytical techniques, biological sample preparation, instrumentation, chromatography, microscopy, spectroscopy etc.

Course Contents/Syllabus:

Descriptors/Topics	**Weightage (%)**
Module I	
Microscopy: Principle, Types and Applications: Florescence microscopy, Confocal Microscopy, Electron microscopy	**25**
Module II	

Chromatography and electrophoretic Techniques: Principle, Types and Applications: Gas Chromatography, Affinity Chromatography, Column Chromatography, Ion exchange Chromatography, TLC, HPLC, GC-MS, ICP-MS Agarose Gel Electrophoresis, Capillary Electrophoresis, Isoelectric Focusing, SDS - Polyacrylamide gel electrophoresis (PAGE)	**25**
Module III	
Spectroscopic Techniques: Principles, types and Applications: IR, NMR, UV-Vis, Florescence Spectroscopy, Mass Spectrometry, Atomic Absorption Spectroscopy (AAS), Circular Dichroism (CD)	**25**
Module IV	
Cell Culture and other Techniques: Principle, Types and Applications: Primary and Secondary Culture, Cell lines and their Maintenance, Cryopreservation, PCR, ELISA, RIA	**25**

Course Outcomes:

By the end of the course, the students will be able to

CO1: Appraise microscopy principles, operate different microscopes, prepare and analyze samples and interpret microscopic images.

CO2: Evaluate the principles, techniques, and applications of chromatography and electrophoresis for the separation, identification, and analysis of biomolecules.

CO3: Appraise the principles, instrumentation, and applications of various spectroscopic techniques for the identification and analysis of chemical and biological molecules.

CO4: Experiment with the knowledge and skills required for aseptic techniques, maintenance, and applications of cell culture in research and biotechnology

Pedagogy for Course Delivery:

The course will be delivered in the form of lectures and discussions.

Assessment/ Examination Scheme:

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu , Siddharth Nagar

Text Books/ References Books:

- GENE CLONING AND DNA ANALYSIS: AN INTRODUCTION, 9TH EDITION (2025). by T A Brown, ISBN: 978-1-394-29256-1
- Wilson And Walker's Principles And Techniques Of Biochemistry And Molecular Biology 8th edition (2018). ISBN 978-1316614761
- Introduction to Light Microscopy Tips and Tricks for Beginners (2019). by Dee Lawlor ISBN 978-3-030-05392-5
- ANIMAL BIOTECHNOLOGY AND CELL CULTURE TECHNIQUES (2024) By A.K. Jha. ISBN No 978-8197178917
- Freshney's Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, 8th Edition. (2021) ISBN: 978-1-119-51304-9.
- Principles of Animal Cell Culture by Basant Kumar Sinha and Rinesh Kumar. (2008).ISBN 978-8181892485
- Gibco Cell Culture Basics Handbook (2020). chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://assets.thermofisher.cn/TFS-Assets/BID/Handbooks/gibco-cell-culture-basics-handbook.pdf

Record Matrix	
To be Filled By Institution	
Date of Introduction of course :	**March 2025 (Proposed)**
Date of Last Revision:	**Not applicable**
Version*:	**1st**
Percentage of revision:	**Not applicable (New Course)**

SIDDHARTH UNIVERSITY

Kapilvastu. Siddharth Nagar (UP)- 272202

Course Title: **Biostatistics and Bioinformatics**
Course Code: ZODC702

Credit Units: 3

Level: Pre-Ph.D

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
3	0	0

Course Objectives:

The Learning Objectives of this course are as follows:

- To understand fundamental statistical concepts relevant to biological research
- To use hypothesis testing methods (e.g., t-tests, ANOVA, chi-square) for biological data interpretation.
- To analyze relationships between variables using regression and correlation techniques.
- To understand the basics of bioinformatics, including sequence alignment
- To interpret high-throughput biological data such as genomics, transcriptomics, and proteomics.

Pre-requisites: Students enrolling in this course should have a foundational understanding of the biology, Statistics, basic computational tools and Biological Databases.

Course Contents/Syllabus:

Descriptors/Topics	**Weightage (%)**
Unit I:	
Variables in biology, collection and classification of data, graphical presentation of qualitative and quantitative data (Bar-diagram, Pie-diagram, Histogram, Frequency polygon), Measures of Central Tendencies (mean, median and mode), measures of dispersion (variance and standard deviation), concept of coefficient of variation, skewness and kurtosis, Correlation and Regression, concept of coefficient of determination.	**25**
Unit II:	

Fundamentals of hypothesis testing, Standard Error points and Interval estimates, Important Non-parametric tests, Definition and applications of Chi-square test, 't' and 'f' test. ANOVA	**25**
Unit III:	
Introduction and scope of Bioinformatics, Bioinformatic Resources, Browsers and Search engines, Biological databases and their types; Nucleotide search, Protein Search, Protein sequence information sources: PIR, ExPASy, UniProt KB, SwissProt, TrEMBL, BLAST search, KEGG pathways.	**25**
Unit IV:	
Sequence Alignment: types and applications, Tools for Sequence Alignment, Multiple sequence alignment tools, Phylogenetic Analysis and tools, Homology Modeling, Domain Search and Prediction, Secondary structure Prediction, Tertiary structure Prediction, Visualization tools.	**25**

Course Outcomes:

By the end of the course,

CO1: The students will be able to select statistical methods to analyze biological data effectively.

CO2: Students will be able to evaluate biological databases to retrieve and interpret biological information

CO3: Students will be able to develop and visualize complex biological data for research and publication

CO4: Students will be able to develop biostatistical and bioinformatics approaches for solving biological research questions

Pedagogy for Course Delivery:

The course will be delivered in the form of lectures and discussions.

Assessment/ Examination Scheme:

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu , Siddharth Nagar

Text Books/ References Books:

- A. Agarwal, R. Yadav, N. Mathur, S.K. Karumanchi, P. Chandra. Text book of Biostatistics and Research methodology (2024). ISBN No 978-93-6087-441-4.

- K. Kalyanaraman; Hareesh N. Ramanathan; P.N. Harikumar. Statistical Methods for Research: A Step-by-Step Approach Using IBM SPSS (2021). ISBN no 978-8126920792.
- Elements of Biostatistics in Health Science (John Willey)- W. Daniell and CL Cross (2018). ISBN: 978-1-119-49657-1
- Biostatistical Analysis- Zerold and Zar (2014). ISBN no **978-9332536678**
- Basic Biostatistics- Chainy, G. B. N., Chainy, G. B. N., Mishra, G., & Mohanty, P. K. (2004), Kalyani Publishers.
- Introduction to bioinformatics- Attwood, T. K., & Parry-Smith, D. J. (2002)
- Essential bioinformatics. Cambridge University Press- Xiong, J. (2006)

Record Matrix	
To be Filled By Institution	
Date of Introduction of course :	**March 2025 (Proposed)**
Date of Last Revision:	**Not applicable**
Version*:	**1st**
Percentage of revision:	**Not applicable (New Course)**