Department of Liberal Education
Era University, Lucknow
Course Outline
Effective From: 2023-24

Name of the Program	**B.A. / B.Sc. (LIBERAL EDUCATION)**			**Year/ Semester:**	**3rd Year/ 5th Semester**
Course Name	Research Methodology, Biostatistics & Bioinformatics	**Course Code:**	**BCH303**	**Type:**	**Theory**
Credits	**04**			**Total Sessions Hours:**	**60 Hours**
Evaluation Spread	**Internal Continuous Assessment:**	**50 Marks**		**End Term Exam:**	**50 Marks**
Type of Course	○ Compulsory	● Core		○ Creative	○ Life Skill
Course Objectives	The objective of this course is to provide conceptual understanding of the steps involved in formulating research concept and steps to execute it, as well analyzing the data. They would be able to search for data through offline and online mode. The students would be provided insight into ethical issues and given guidelines for this. The objective of the paper is to introduce the students to various tools of bioinformatics and their application in biological research.				
Course Outcomes(CO): ***After the successful course completion, learners will develop following attributes:***					
Course Outcome (CO)	**Attributes**				
CO1	The students will be able to identify the objective and formulate the research methodology and ethics while designing, execution and analyzing data for research.				
CO2	The student will know about the basics of bio-statics and its uses.				
CO3	The students would be aware of bioinformatics tools and its uses				
CO4	The students would have information regarding various soft-wares and databases for analyzing molecular biology data				
Pedagogy	Interactive, discussion-bases, student-centered, presentation.				
Internal Evaluation Mode	Mid-term Examination: 20 Marks Activity: 10 Marks Class test: 05 Marks Online Test/Objective Test: 05 Marks Assignments/Presentation: 05 Marks Attendance: 05 Marks				
Session Details	**Topic**			**Hours**	**Mapped CO**
Unit 1	**General principles of research:**			17	CO1

	• Meaning and importance of research • Critical thinking • Formulating hypothesis and development of research plan • Review of literature, interpretation of results and discussion **Technical writing:** • Scientific writing • Writing research paper • Poster preparation and Presentation • Dissertation. **Library:** • Classification systems • e-Library • Reference management • Web-based literature search engines **Intellectual Property Rights:** • Intellectual Property • Intellectual property protection (IPP) and intellectual property rights (IPR) • WIPO (World Intellectual Property Organization) • Concept and rules for Patenting, Copyright, Trademark, Geographical indicators , Biopiracy **Technology Development:** • Transfer • Commercialization related aspects • Ethics and values in IP. **Activity:** Preparation of list of references for given topic in various formats		
Unit 2	**Biostatistics:** • Definition, application, • Sample size, importance of sample size, factors influencing sample size, dropouts **Statistical tests:** • of significance, type of significance tests, • parametric tests (students "t" test, ANOVA, Correlation Coefficient, regression) **Nonparametric tests:** • Wilcoxon rank tests, • Analysis of variance, correlation, • Chi square test, • null hypothesis, P values, degree of freedom, and	15	CO2

	interpretation of P values. **Statistical Package for the Social Sciences (SPSS)** **Activity:** Doing analysis on SPSS		
Unit 3	**Introduction to bioinformatics:** • Historical background. • Scope of bioinformatics • Role of supercomputers in biology. **Computer fundamental programs**: • Introduction to programming languages in bioinformatics **Applications of bioinformatics**: • Fundamental information about biological databases and data retrieval • Genomics, proteomics, computer aided drug design (structure based and ligand based approaches) and Systems Biology. **Introduction to biological databases** – • primary, secondary and composite databases, • NCBI **Activity:** Writing a small proposal for research purpose in a given format and its discussion	13	CO3, CO4
Unit 4	**Nucleic acid databases** : • GenBank, EMBL, DDBJ, NDB • Introduction and use of OMIM, BLAST, Fasta format, Chromas, Entrez **Introduction to Protein databases:** • Expasy (Expert Protein analysis system), • (PIR, Swiss-Prot, TrEMBL, PDB), • metabolic pathway database (KEGG, EcoCyc, and MetaCyc), • small molecule databases (PubChem, Drug Bank) **Structure viewers**: Ras Mol, J mol, file formats **Activity:** Sequence alignment through chromas	15	CO4

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	1	1	3	3	1	3	2	2	2	2	1
CO2	3	2	3	2	2	2	2	2	2	2	2	2	2	2
CO3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
CO4	3	2	2	3	3	2	2	2	3	3	2	2	3	2

Strongcontribution-3, Averagecontribution-2, Lowcontribution-1,

Suggested Readings:	
Text-Books	1. Research Methodology & Biostatistics, 1e : Suresh, Sharma, Elsevier Publications 2. Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery by S. C. Rastogi. PHI Publishers
Reference Books	1. Research Methodology - CR Kothari. New Age International Publishers 2. "Biostatistics: A Foundation for Analysis in the Health Sciences" by Wayne W. Daniel and Chad L. Cross .Wiley-Interscience Publisher. Latest Edition 3. Information-theoretic Perspectives of Bioengineering and Biological Complexes. Perambur S Neelakanta. World Scientific Publications 4. Bioinformatics: A Practical Guide To The Analysis Of Genes And Proteins, 3Rd Edition by Baxevanis Andreas D et al, Wiley India
Para Text	• Biostatistics and Research Methodology | Introduction of Research Part-1| AKTU Digital Education: https://youtu.be/_tO5frdZOn4 • https://books.google.com/books/about/Research_Methodology_and_Biostatistics_E.html?id=ddc6EAAAQBAJ • Concepts and importance of Bioinformatics: https://youtu.be/sREv4rfpbCY

Recapitulation & Examination Pattern

Component	Marks	Pattern
Mid Semester	20	**Section A:** Contains **10** MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries **0.5Marks.** **Section B:** Contains **07** descriptive questions out of which **05** questions are to be attempted. Each question carries **03 Marks**.
Activity	10	Will be decided by subject teacher
Class Test	05	Contains **05 descriptive questions.** Each question carries **01** Mark.
Online Test/ Objective Test	05	Contains **10 multiple choice questions.** Each question carries **0.5**Marks.
Assignment/ Presentation	05	Assignment to be made on topics and instruction given by subject teacher
Attendance	05	As per policy
Total Marks	**50**	

Course created by: Dr. Ghazala Zaidi

Signature:

Approved by: Prof. Sudhir Mehrotra

Signature: