

Name of the Programme : M.Sc. Part-II (Biochemistry)
Course Code : CHB-605
Title of the Course : Research methodology, Biostatistics and Bioethics
Number of Credits : 4
Effective from AY : 2022-23

Pre-requisites for the Course:	Students should have studied biochemistry courses at MSc. part I level.	
Course Objectives:	1. To develop a basic understanding of various types of biological data, its handling and processing. 2. To introduce various technical writing skills. 3. To understand various ethical considerations while studying biological data.	
Content:		No of hours
	1. Introduction to Research, Research Design & literature review a. Basics of research - Definition and meaning of research, the significance of research, research & scientific method. - Types of research, criteria for good research, problems encountered by researchers in India, selecting & defining a research problem. - Research approaches: research methods vs methodology. - Basic principles of experimental designs, sampling, sample size determination, plan for data collection, methods of data collection, plan for data processing and analysis. b. Literature Review - Primary and secondary Sources - Web sources –critical literature review - Hypothesis – Different types, significance, development of working hypothesis, null hypothesis - Research Methods: Scientific method vs arbitrary method, logical scientific methods: deductive, inductive, deductive-inductive, pattern of deductive – inductive logical process, different types of inductive logical methods	10
	2. Technical writing - Different forms of technical writing: articles, research notes and reports in journals, review articles, monographs, dissertations, bibliographies. - How to formulate outlines: The reasons for preparing outlines, guide for plan of writing, skeleton for the manuscript, drafting titles, subtitles, tables, illustrations. - Parts of dissertation/research report/article: introduction, review of literature, method, results and discussion.	5

	d. Significant subtopics related to scientific writing such as content, its continuity, clarity, validity, internal consistency and objectivity e. Basic attributes for writing for grants	
	3. Introduction to Biological data a. Basic characteristics of biological data Variables and constants, discrete and continuous variables, relationship and prediction, variables in biology (measurement, ranked, attributes), derived variables (ratio, index, rates). b. Types of measurements in biological data - Interval scale, ratio scale, ordinal scale, nominal scale, discrete and continuous data, exact and approximate numbers. - Classification of errors, decimal notation and rounding off numbers, absolute and relative errors, valid significant digits, relationship between number of valid digit and error, the error of sum, difference, product, quotient, power and root and rules of calculating digits.	10
	4. Data handling a. Population and Sampling - Random samples, parameter and statistics, accuracy and precision, accuracy in observations - Tabulation and types of frequency distribution: relative & cumulative. - Graphical representation: types of graphs, preparation and their applications. b. Measures of central tendency: - Characteristics of ideal measure, arithmetic mean – simple, weighted, combined, and corrected mean, limitations of arithmetic mean; - Median – calculation for raw data, for grouped data, for continuous series, limitations of median; - Mode – computation of mode for individual series, by grouping method, in a continuous frequency distribution, limitations of modes - Relationship between mean, median and mode c. Measures of dispersion: - Variability, Range, mean deviation, coefficient of mean deviation, standard deviation (individual observations, grouped data, continuous series) - Variance, coefficient of variance, limitation. - Skewness – definition, positive, negative, purpose, measure, relative measure, iv. Karl Pearson's coefficient, Bowley's coefficient, Kelly's measure, moments.	15
	5. Correlation analysis, Population Biostatistics and Hypothesis testing a. Covariance, correlation coefficient for ungrouped and	15

	grouped data, scatter and dot diagram (graphical method) - Regression analysis - linear and exponential function - Examples: DNSA conversion by reducing sugar, survival/growth of bacteria, regression coefficients, regression analysis for linear equations. b. Population Biostatistics - Concept of probability, theories of probability- additive and multiplicative theory - Probability distributions: binomial, poisson and normal c Hypothesis testing. - Hypothesis and its types: Null and Alternative - Level of significance, one tailed and two tailed test, test for single mean and single proportion, critical region, level of confidence, level of significance, - Parametric and Non- Parametric test t-test, Z- test. F-test and ANOVA Introduction to Chi-square test	
	6. Bioethics - Bioethics: Definition, ethics in biology, role and importance of ethics in biology, basic approaches to ethics. - Legal and regulatory values related to bioethics. - Bioethics in Healthcare, agriculture, biotechnology, animal welfare and rights/PETA in research, wildlife conservation and management, commercialization in scientific research. - Bioethics related to genetically modified organisms (GMOs): concerns about GMOs, benefit and risk of GMOs, reasoning behind acceptance and rejection of GMOs. - Past and present bioethical conflicts in life sciences. - Biopiracy, ethical committees, copyright, royalty, IPR and patent law, plagiarism, citation and acknowledgement. - Bio-waste disposal: Types of biowaste, ways to dispose of biowaste.	5
Pedagogy:	Mainly lectures and tutorials. Seminars / term papers /assignments / presentations / self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	
References/readings.	- W .W. Daniel, Biostatistics: Basic Concepts and Methodology for the Health Sciences, Wiley publishers, 10th Edition,2014. C. R. Kothari, Quantitative Techniques, Vikas Publishing House, 3rd Edition, 2013. - Deal H Glasman, Science Research Writing, Imperial College Press, 2010. R. K. Surya, Biostatistics for health and life sciences, Himalaya Publishing House, 1st Edition, 2010. A. Annadurai, A Textbook of Biostatistics, New Age Publication, 1st edition, 2017. B. Antonisamy, P.S.Premkumar and S. Christopher, Principles and	

	Practice of Biostatistics, Elsevier India, 1 st Edition, 2017. 7. P. N. Arora and P. K. Malhan, Biostatistics, Himalaya Publishing House. 9 th Edition, 2006.
Course Outcomes:	1. Students will be able to collect, handle, process and present the biological data. 2. Students will be able to apply statistical methods to biological data. 3. Students will be able to develop the skills needed to successfully communicate through technical writing skills. 4. Students will be able to apply the basic concepts learned to carry out research in future.

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