

Programme: M.Sc. (Microbiology)

Course Code: MIC 104

Title of the Course: BIOSTATISTICS

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	Basic ability to handle numbers and calculation.	
Objective:	The paper develops concepts about types of data observed in biological experiments, its handling and processing. It develops concepts of hypothesis and formulation of experiments. It gives understanding of various statistical operations needed to carryout and process the biological data.	
Content:		
1.		
1.1	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), types of measurements of biological data (interval scale, ratio scale, ordinal scale, nominal scale, discrete and continuous data). Elementary theory of errors: exact and approximate numbers, source and 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, rules of calculating digits.	(03) (04)
1.2	Data handling: Population and samples, random samples, parameter and statistics, accuracy and precision, accuracy in observations, Tabulation and frequency distribution, relative frequency distribution, cumulative frequency distribution. Graphical representation: types of graphs, preparation and their applications.	(05)
2.		
2.1	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; mid-range.	(03)
2.2	Measure 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	(04)

	measure, Karl Pearson's Coefficient, Bowley's Coefficient, Kelly's Measure, Moments.	
2.3	Correlation analysis – Correlation, covariance, correlation coefficient for ungrouped and grouped data, Pearson's Rank Correlation coefficient, scatter and dot diagram (graphical method). Regression analysis - Linear and exponential function - examples: DNSA conversion by reducing sugar, survival/growth of bacteria, regression coefficients, properties, standard error of estimates, prediction, regression analysis for linear equation.	(05)
3.		
3.1	Probability: Probability, Combinatorial Techniques, Elementary Genetics, Binomial, Poisson, Normal Distributions.	(04)
3.2	Hypothesis Testing – parameter and statistics, sampling theory, sampling and non-sampling error, estimation theory, confidence limits, testing of hypothesis, test of significance; Students' T-test, t-distribution, computation, paired t-test.	(04)
3.3	Chi-square test, F-test and ANOVA.	(04)
Pedagogy:	Lectures/tutorials/assignments/self-study/MOODLE/Videos	
References/Readings	Kothari, C. R., Quantitative Techniques, Vikas Publishing House.	
	Arora, P. N. and Malhan, P. K., Biostatistics, Himalaya Publishing House.	
	Danilina, N.I., Computational Mathematics, Mir Publishers.	
	Surya, R. K., Biostatistics, Himalaya Publishing House.	
Learning outcomes	Able to collect, handle, process and present the Biological Data. Apply the principles of statistics on biological experiments.	