DISCIPLINE SPECIFIC CORE COURSE- 9 (DSC-9) BIOSTATISTICS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
BIOSTATISTICS	4	3	-	1		NA

Learning objectives

The Learning objectives of this course are as follows:

- To acknowledge, appreciate and effectively incorporate the basic statistical concepts indispensable for carrying out and understanding biological hypotheses, experimentation as well as validations.
- The course is aimed to create awareness about the applications of statistics in biological sciences along with building confidence in students to test their experimental data with an appropriate test of significance.

Learning outcomes

Having successfully completed this course, students shall be able to:

- Appreciate the importance of statistics in biological sciences. They will also understand the concept of different variables and data types, and also the sampling techniques.
- Learn different measures of central tendency and dispersion with their applications. The students will also learn symmetric and asymmetric distributions, and kurtosis of distributions.
- Identify the degree of uncertainty in making important decisions, learning joint probability, conditional probability, Bayes' theorem and solving its application-level problems.
- Learn about the characteristics of normal, binomial and Poisson probability distributions. They will learn how to identify which type of distribution fits the given data and estimate probabilities for random variables in these distributions
- Determine the strength of the relationship between two variables and also to predict the value of one variable given a value of another variable.
- Learn how to formulate statistical hypotheses for testing and application of different tests of significance for hypothesis testing for different biological problems.

SYLLABUS OF DSC-9

Unit I: Introduction to Biostatistics **(02 Hours)**

Types of data in biology, random variables: discrete and continuous. sample and population, techniques of sampling (random and stratified), sampling and non-sampling errors.

Unit II: Descriptive Statistics **(08 Hours)**

Measures of central tendency: arithmetic mean, mode, median and partition values. Measures of dispersion: range, standard deviation, coefficient of variance and covariance, masures of skewness: Pearson's Coefficient of skewness, and concept of kurtosis (platykurtic, mesokurtic and leptokurtic).

Unit III: Probability (05 Hours)
Basic concepts, addition and multiplication, rules of probability, conditional probability, Bayes' theorem and its applications in biostatistics.

Unit IV: Probability distributions (06 Hours)
Binomial and normal distributions along with their properties and relationships. Introduction to poisson distribution.

Unit V: Correlation and Linear Regression (06 Hours)
Correlation analysis: scatter diagrams, Pearson's and Spearman's coefficient of correlation, coefficient of determination.
Simple linear regression analysis: method of least squares, equations of lines of regression and their applications in biostatistics.

Unit VI: Hypothesis testing (18 Hours)
Sampling distributions and standard error, Null and Alternate hypothesis, Basic concept and illustrations of type I and type II errors, concept of confidence interval estimation. Large sample tests for single mean and difference of means.
Student's t-distribution: test for single mean, difference of means and paired t-test. Chi-square distribution: test for goodness of fit, independence and homogeneity. F-test, one-way and two-way analysis of variance (ANOVA).Non-parametric analysis: The Sign test and The Wilcoxon signed-rank test.

Practical component (30 Hours)

The computer-based experiments are designed for students to solve biostatistics problems. All theoretical concepts would be covered in the practical using any spreadsheet software like MS EXCEL.

1. Represent different types of data in tables and graphs (Line chart, histogram, bar chart, frequency polygon, pie chart).
2. Calculate various measures of central tendency (Arithmetic mean, mode, median and partition values) and dispersion (Range, standard deviation, coefficient of variance and covariance).
3. Calculate probabilities for different distributions- normal and binomial.
4. Prepare scatter plot between two variables and interpret the relationship between them using correlation and simple linear regression analysis.
5. Perform large sample test for single mean and difference of means.
6. Perform Student's t-test for one sample, independent samples, and paired samples.
7. Perform Chi-square test.
8. Perform One-way ANOVA.
9. Perform Two-way ANOVA.
10. Perform Non-parametric analysis: The Sign test or The Wilcoxon signed-rank test.

Essential readings:

- Daniel, W.W. and Cross, C.L. (2019). 11th Edition. Biostatistics: A foundation for analysis in the health sciences. New York, USA: John Wiley & Sons. ISBN: 9781119588825.
- Pagano, M. and Gauvrean, K. (2018). 2nd Edition. Principles of biostatistics. California, USA: Duxbury Press. ISBN-13: 9781138593145.
- Schmuller, J. (2016). Statistical Analysis with Excel for Dummies. 5th Edition. New York, USA: John Wiley & Sons. ISBN: 9781119844549.

Suggestive readings for basics:

- Glantz, S. (2012). 7th Edition. Primer of biostatistics. New York, USA: McGraw-Hill Medical. ISBN: 9780071781503.
- Triola M.M., Triola M.F., Roy J. (2019). Biostatistics for Biological and Health Sciences. Harlow, UK: Pearson Education Ltd.
- Zar, J.H. (2014). 5th Edition. Biostatistical analysis. USA: Pearson. ISBN: 9789332536678.