GENERAL ELECTIVE - (BIOMED-GE): STATISTICAL CONCEPTS IN BIOLOGY

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		
Statistical Concepts in Biology	4	3	-	1	XII Passed	Basic knowledge of Biology

Learning Objectives

- The purpose of the course is to teach fundamental concepts and techniques of descriptive and inferential statistics with applications in health care, medicine, public health, and epidemiology.
- The course will prepare students to collect, analyze and interpret biological data sets and provide quantitative evidence to support scientific conclusions

Learning outcomes

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

- Recognise the importance of statistics in biological sciences, understand the different types of data and difference between population and sample.
- Learn how to group data into tabular form and present it in various graphical forms.
- Learn the calculation and application of measures of central tendency and measures of dispersion in data representation.
- Understand concepts of discrete and conditional probability and apply these concepts to biological applications.
- Understand the significance and basic concepts of correlation and simple linear regression analysis.
- The student will be able to learn the process of hypothesis formulation, and utilization of appropriate test of significance for biological data analysis.

SYLLABUS

Unit I: Types of Statistical Data and Measurement (06 Hrs)

Importance of Statistical Studies in Biology. Types of Data in Biology: Qualitative, Quantitative and Random (Discrete and Continuous) Variables. Scales of Measurement: Nominal, Ordinal, Interval and Ratio scale. Sample and Population.

Unit II: Data Organization and Graphical Representation (06 Hrs)

Ordered array, Grouped Frequency Distribution Table. Charts and Diagrams: Bar diagram, Pie chart, Histogram, Frequency Polygon, Line chart, Cumulative Frequency Curve and Scatter diagram.

Unit III: Descriptive Statistics (10 Hrs)

Measures of Central Tendency: Mean, Mode, Median, Partition Values. Measures of Dispersion: Range, Standard Deviation, Coefficient of Variance, Covariance. Concept and Importance of Skewness and Kurtosis.

Unit IV: Probability (07 Hrs)

Concepts of Probability, Addition and Multiplication Rules and Conditional Probability. Use of Probability in Assessing Validity (Sensitivity/Specificity) of a Diagnostic Test.

Unit V: Correlation and Linear Regression Analysis (07 Hrs)

Correlation Analysis: Scatter diagram, Pearson's and Spearman's Coefficients of Correlation, Coefficient of Determination. Regression Analysis: Concept of Line of Best Fit, Equations of Lines of Regression and their Applications in Biostatistics.

Unit V: Inferential Statistics (09 Hours)

Sampling Distribution and Standard Error. Concept of Null and Alternate Hypothesis. Biological Data Analysis using Z-Test (Single Mean and Difference of Means), Student's T-Test (Single Mean, Difference of Means and Paired T-Test) and F-Test.

Practical (30 hrs)

The experiments are designed for students to learn the usage of statistical methods for biological data analysis using spreadsheets.

1. Hands-on training of Microsoft excel software to perform basic operations, commands and functions.
2. Organize the given data set and make frequency distribution table.
3. Present data in various charts or diagrams (bar diagrams, histograms, pie charts, Line graph and scatter diagrams).
4. Computing measures of central tendency and dispersion using biological data.
5. Correlation analysis to determine the strength of relationship between a set of dependent and independent variable.
6. Compute regression equations to predict the value of dependent variable.
7. Perform Z-test (Single Mean and Difference of Means).
8. Perform student's t-test (Single Mean, Difference of Means and Paired T-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-13: 9781119588825.
- Triola M.M., Triola M.F., Roy J. (2019). 2nd Edition. Biostatistics for Biological and Health Sciences. Harlow, UK: Pearson Education Ltd. ISBN-13: 9789353436537.
- Pagano, M. and Gauvrean, K. (2018). 2nd Edition. Principles of Biostatistics. California, USA: Duxbury Press. ISBN-13: 9781138593145.
- Schmuller, J. (2016). 5th Edition. Statistical Analysis with Excel for Dummies. New York, USA: John Wiley & Sons. ISBN-13: 9781119844549.

Suggestive readings:

- Zar, J.H. (2014). 5th Edition. Biostatistical analysis. USA: Pearson. ISBN-13: 9789332536678.
- Glantz, S. (2012). 7th Edition. Primer of biostatistics. New York, USA: McGraw-Hill Medical. ISBN-13: 9780071781503