GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Science

Level: Under Graduate

Branch Name: Honors/ Honors With Research (Biotechnology)

Course / Subject Code: BS04001041

Course / Subject Name: Biostatistics

W.e.f. Academic Year:	2025-26
Semester:	4
Category of the Course:	Minor Elective Subject

Prerequisite:

Students should have a foundational understanding of basic mathematics, statistics, and biology. Familiarity with probability, data representation, and fundamental biological concepts will be beneficial for understanding biostatistical methods.

Rationale:

This course is designed to provide undergraduate students with theoretical knowledge and practical applications of statistical methods in biological and medical research. The course will equip students with essential skills in data analysis, interpretation, and decision-making relevant to biomedical and life sciences.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		**Practical**		
L	**T**	**PR**	**C**	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	70	30	30	200

Course Content:

1	Introduction to Biostatistics: Definition, scope, and applications of biostatistics. Types of data, scales of measurement, data presentation techniques (tables, graphs, charts). Descriptive statistics: Measures of central tendency (mean, median, mode) and dispersion (variance, standard deviation, range, quartiles).	**9**	**20**
2	Probability and Distributions: Basics of probability, probability distributions (binomial, Poisson, normal), central limit theorem,	**9**	**20**
3	Inferential Statistics: Estimation and confidence intervals, parametric and non-parametric tests (t-tests, chi-square, ANOVA, Mann-Whitney U test). Correlation and regression analysis. Hypothesis Testing	**10**	**22**

4	Experimental Design and Sampling Techniques: Types of sampling methods, sample size determination, randomized control trials, observational vs. experimental studies, bias in statistical studies.	**10**	**22**
5	Applications of Biostatistics in Health and Life Sciences: Epidemiological studies, bioinformatics data analysis, statistical tools in genetic research, survival analysis, meta-analysis.	**7**	**16**

Reference Books:

1. Wayne W. Daniel, "Biostatistics: A Foundation for Analysis in the Health Sciences," Wiley.
2. Bernard Rosner, "Fundamentals of Biostatistics," Cengage Learning.
3. Marcello Pagano and Kimberlee Gauvreau, "Principles of Biostatistics," CRC Press.
4. Ronald N. Forthofer, Eun Sul Lee, and Mike Hernandez, "Biostatistics: A Guide to Design, Analysis, and Discovery," Academic Press.
5. P.S.S. Sunder Rao and J. Richard, "Introduction to Biostatistics and Research Methods," PHI Learning.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
1	Understand the fundamental concepts of biostatistics and their application in biological research.	UN, RM, AN
2	Apply probability and statistical tests to analyze biological and medical data.	UN, AN
3	Conduct and interpret statistical analyses, including hypot	AN, EL
4	Design biological experiments, analyze epidemiological data, and assess statistical methods in research.	AN

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

List of Experiments:

Module 1: Introduction to Biostatistics (4 Hours)

1. Data Classification & Entry in Excel – Identify and enter categorical and numerical data.
2. Data Sorting, Filtering, and Cleaning – Use Sort & Filter, Remove Duplicates, and Data Validation.
3. Data Visualization in Excel – Create bar charts, histograms, and pie charts for epidemiological data.

Module 2: Descriptive Statistics (5 Hours)

4. Calculating Mean, Median, Mode – Use AVERAGE, MEDIAN, MODE functions on patient health data.
5. Measuring Variance & Standard Deviation – Use VAR.P, VAR.S, STDEV.P, STDEV.S for clinical datasets.
6. Interquartile Range (IQR) & Boxplots – Compute QUARTILE.EXC, QUARTILE.INC and create boxplots.

Module 3: Probability and Distributions (4 Hours)

7. Binomial Probability Calculation – Use BINOM.DIST for genetic probability calculations.
8. Normal Distribution & Z-Scores – Compute probabilities using NORM.DIST, NORM.INV.
9. Poisson Distribution for Disease Outbreaks – Use POISSON.DIST to model infection rates.

Module 4: Inferential Statistics (6 Hours)

10. T-tests in Excel (One-sample & Two-sample) – Use T.TEST to compare pre- and post-treatment results.
11. Chi-square Test for Categorical Data – Use CHISQ.TEST for comparing disease prevalence.
12. ANOVA for Group Comparisons – Use ANOVA in Excel Data Analysis ToolPak.

Module 5: Experimental Design and Sampling (5 Hours)

13. Random Sampling in Excel – Use RAND() and RANDBETWEEN() to generate random samples.
14. Calculating Sample Size – Apply formulas manually and validate with Excel Solver.
15. Identifying Bias in Data Collection – Analyze datasets to detect sampling errors.

Module 6: Applications in Biostatistics (6 Hours)

16. Correlation Analysis in Excel – Compute CORREL and create scatter plots.
17. Linear Regression for Predictive Modeling – Use LINEST & TREND functions for disease prediction.
18. Survival Analysis using Kaplan-Meier Method – Use conditional formatting and COUNTIF for survival rates.

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