

Course Code	Course Title	L	T	P	C
1151BT105	Biostatistics	3	0	0	3

Course Category: *Foundation*

a. Preamble: *Engineers of the present day have to handle large data in their applications. Hence data analysis has been an important part of Bio Technology. This course has been designed to enable the students to understand the applications of various statistical tools in Biology. It provides familiarity with descriptive as well as analytical methods for understanding the variability in observed data. It develops skills in the selection of samples from population and carrying out different tests of hypotheses. It provides the basics of designing an engineering experiment. It provides an opportunity to learn the applications of these techniques to biology.*

b. Pre-requisite Course: *Higher Secondary Level Mathematics.*

c. Related Courses: *Construction planning schedule, Surveying, Measurement and metrology, Statistical Quality Control.*

d. Course Educational Objectives:

- *To grasp the idea of the role of Statistics in solving engineering problems.*
- *To understand the requirements for the existence of a relationship between two variables.*
- *To acquaint with the concept of sampling.*
- *To carry out tests of hypotheses on the samples to arrive at conclusions on the population.*
- *To understand the difference between fixed and random factors.*

e. Course Outcomes:

Upon the successful completion of the course, the students will be able to:

Co. No.	Course Outcome	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Acquaint with the role of Statistics in finding solutions to engineering problems.	K3
CO2	Apply descriptive statistics to interpret the data.	K3
CO3	Compute point and interval estimators for mean, variance and proportion.	K3
CO4	Structure decision-making problems in engineering as tests of hypotheses.	K3
CO5	Apply one-way and two-way analysis of variance to	K3

problems in engineering.	
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e. Course Content:

UNIT-I

The Role of Statistics in Engineering:

The Engineering Method and Statistical Thinking - Collecting Engineering Data - Basic Principles - Retrospective Study - Observational Study - Designed Experiments - Observing Processes Over Time - Mechanistic and Empirical Models.

Data Description and Representation:

Collection of data- Classification and Tabulation of data - Stem-and-Leaf Diagrams - Frequency Distributions and Histograms - Box Plots - Time Sequence Plots - Probability Plots .

UNIT-II

Descriptive Statistics: Measures of central Tendency-Measures of Dispersion-Skewness and Kurtosis.

Correlation and Regression: Types of Correlation – Scatter Diagram – Karl Pearsons Coefficient of Correlation and Spearman's Rank Correlations- Method of Least Squares - Regression (The two regression lines).

UNIT-III

Sampling: Different types of sampling - Sampling Distributions - Sampling Distribution of Mean.

Point Estimation of Parameters: General Concepts of Point Estimation - Unbiased Estimators - Variance of a Point Estimator - Standard Error- Methods of Point Estimation (Method of Moments - Method of Maximum Likelihood).

Statistical Intervals for a Single Sample: Confidence Interval on the Mean of a Normal Distribution with Variance Known - Confidence Interval on the Mean of a Normal Distribution with Variance Unknown - Confidence Interval on the Variance and Standard Deviation of a Normal Distribution - A Large-Sample Confidence Interval for a Population Proportion

UNIT-IV

Tests of Hypotheses for a Single Sample: Tests of Statistical Hypotheses - General Procedure for Hypothesis Testing – Tests on the Mean of a Normal Distribution with Variance Known - Tests on the Mean of a Normal Distribution with Variance Unknown - Tests on the Variance and Standard Deviation of a Normal Distribution.

Statistical Inference for Two Samples: Inference For a Difference in Means of Two Normal Distributions with Variances Known - Inference For a Difference in Means of Two Normal Distributions with Variances Unknown - Inference on the Variances of Two Normal Distributions – Inference on Two Population Proportions.

UNIT-V

The Analysis of Variance: Concept – Assumptions-One way classification and two-way classifications.

Designing Engineering Experiment: Concept of Randomization, Replication and local control - Completely Randomized Design - Randomized Block Design – Latin square Design.

h. Text Books

1. Douglas C. Montgomery and George C. Runger. *Applied Statistics and Probability for Engineers*, (3rdEdn), John Wiley and Sons, Inc., New York, 2003.
2. Robert H. Carver and Jane Gradwohl Nash. *Doing Data Analysis with SPSS Version 18.0*, (Indian Edition), Cengage Learning, New Delhi, 2012.

ii. Reference Books

1. Mohammed A.Shayib. *Applied Statistics*, First Edition. eBook, Bookboon.com 2013.
2. Peter R.Nelson, Marie Coffin, Copeland Kanen, A.F. *Introductory Statistics for Engineering Experimentation*, Elsevier Science and Technology Books, New York, 2003.
3. Richard A. Johnson and C.B.Gupta, *Probability and Statistics for Engineers*, (7thEdn.), Pearson Education, Indian Impression 2006.
4. Sheldon M. Ross, *Introduction to Probability and Statistics*, (3rdEdn), Elsevier Science and Technology Books, New York, 2004.
5. T.T.Soong, *Fundamentals of Probability and Statistics for Engineers*, John Wiley and Sons, Ltd., New York, 2004.
6. J.P.Marques de Sá , *Applied Statistics using SPSS, STATISTICA, MATLAB and R*, (2ndEdn.), Springer Verlag, Heidelberg, 2007.

COMPUTATIONAL LABORATORY

1. Construction of Univariate and Bivariate frequency tables with samples of sizes not exceeding 200.
2. Diagrammatic and Graphical representation of data.
3. Computation of Measures of Central tendency, Measures of Dispersion, Skewness and Kurtosis.
4. Computation of Simple Correlation and Regression Coefficients.
5. Fitting of discrete distributions – Binomial, Poisson,
6. Fitting of continuous distributions – Normal distribution
7. Drawing samples of size not exceeding 25 from normal population with known mean and variance using random number tables.
8. Problems based on MLE
9. Problems based on t-distribution, chi-square distribution and F-distribution
10. Test of Independence attributes ($m, n \leq 5$)
11. Test for Homogeneity of several population variances.
12. Tests of significance with regard to Single Mean, Two Means,
13. Construction of Confidence intervals for Mean, Variance and Proportion based on Normal, t, Chi-square and F distributions.
14. Analysis of Variance (One way and two-way classifications)
15. Analysis of CRD, RBD, and LSD.

h. Learning Resources

i. Text Books

1. Douglas C. Montgomery and George C. Runger. *Applied Statistics and Probability for Engineers*, (3rdEdn), John Wiley and Sons, Inc., New York, 2003.
2. Robert H. Carver and Jane Gradwohl Nash. *Doing Data Analysis with SPSS Version 18.0*, (Indian Edition), Cengage Learning, New Delhi, 2012
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4. T.T.Soong, *Fundamentals of Probability and Statistics for Engineers*, John Wiley and Sons, Ltd., New York, 2004.
5. J.P.Marques de Sá , *Applied Statistics using SPSS, STATISTICA, MATLAB and R*, (2ndEdn.), Springer Verlag, Heidelberg, 2007.

Online resources

<http://apus.libguides.com> , www.mii.lt, www.sosmath.com, www.macalester.edu,
www.nptel.iitm.ac.in www.purplemath.com