Statistics and Probability

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| Semester | Credit Hours | Prerequisite |
| [BSCS-5 M] | [3+0] | None |

Course Code:

## Course Description

This course provides an elementary introduction to probability and statistics with applications. Topics include: sample spaces, conditional probability, Bayes' rule, random variables, probability distribution of continuous and discrete random variables, inference, hypothesis testing, confidence intervals, linear and multiple regression.

## Course Learning Outcomes (CLOs)

The course learning outcome along with domain and taxonomy level are listed below

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| --- | --- | --- | --- |
| S. # | CLO Statement | Domain | Taxonomy Level PLO |
| CLO-1 | EXPLAIN fundamental concepts related to probability and statistics | C | C2 PLO-1 |
| CLO-2 | USE of probability formulas and probability distributions | C | C3 PLO-2 |
| CLO-3 | APPLY regression and statistical techniques on different problems | C | C3 PLO-2 |
| \* BT= Bloom’s Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain | | | |

## Course Materials

This course introduces the following topics to students:

* Introduction to Statistics and Data Analysis, Statistical Inference, Samples, Populations, Role of Probability, Sampling Procedures, Discrete and Continuous Data, Statistical Modeling.
* Probability: Sample Space, Events, Counting Sample Points, Probability of an Event, Additive Rules, Conditional Probability, Independence, Product Rule, Bayes’ Rule.
* Random Variables and Probability Distributions.
* Mathematical Expectation: Mean of a Random Variable, Variance and Covariance of Random Variables, Means and Variances of Linear Combinations of Random Variables, Chebyshev’s Theorem.
* Discrete Probability Distributions.
* Continuous Probability Distributions.
* Fundamental Sampling Distributions and Data Descriptions: Random Sampling, Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem, Sampling Distribution of S2, t-Distribution, F-Quantile and Probability Plots, Single Sample & one- and Two-Sample Tests of Hypothesis (P-Values for Decision).
* Linear Regression and Correlation: Least Squares and the Fitted Model, Linear Regression Model Using Matrices, Multiple Linear Regression, Nonlinear Regression Models.

## Course Weekly Schedule

The course schedule for 16 weeks are detailed below

| Week | Topic |
| --- | --- |
| 1 | Introduction to Statistics and Data Analysis |
| 2 | Mean and Variance and Graphs |
| 3 | Counting Sample Points, Sample Space, Events |
| 4 | Probability of an Event, Additive Rules |
| 5 | Conditional Probability, Bayes’ Rule |
| 6 | Random Variables and Probability Distributions |
| 7 | Mathematical Expectation, Chebyshev’s Theorem |
| 8 | Discrete Probability Distributions |
| 9 | Continuous Probability Distributions |
| 10 | Random Sampling, Sampling Distribution of Means and the Central Limit Theorem |
| 11 | Linear Regression and Correlation: Least Squares and the Fitted Model |
| 12 | Linear Regression Model Using Matrices |
| 13 | Multiple Linear Regression |
| 14 | Sampling Distribution of S2 |
| 15 | t-Distribution, F-Quantile, Probability Plots |
| 16 | Single Sample & one- and Two-Sample Tests of Hypothesis (P-Values for Decision) |

## Recommended Textbooks

1. Probability and Statistics for Engineers and Scientists by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying E. Ye Publisher Pearson.
2. Probability and Statistics for Engineers and Scientists by Anthony J. Hayter.
3. Schaum's Outline of Probability and Statistics, by John Schiller, R. Alu Srinivasan and Murray Spiegel, McGraw-Hill; 3rd Edition (2008). ISBN-10:0071544259.