**COURSE BASICS**

Course Title**: Probability and statistics**

Course Code**: GSC-112**

Credit Hours**: 3+0**

Prerequisite**: None**

Instructor**:** **Dr. Muhammad Hussain**

Email**:** **engr.m.hussain.bukc@bahria.edu.pk**

**Course Objectives:**

Course Content: Introduction to Statistics and Data Analysis, Statistical Inference, Samples, Populations, and the Role of Probability. Sampling Procedures. Discrete and Continuous Data. Statistical Modeling. Types of Statistical Studies. Probability: Sample Space, Events, Counting Sample Points, Probability of an Event, Additive Rules, Conditional Probability, Independence, and the 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 Estimation Problems. Single Sample & One- and Two-Sample Tests of Hypotheses. The Use of P-Values for Decision Making in Testing Hypotheses (Single Sample & One- and Two-Sample Tests), Linear Regression and Correlation. Least Squares and the Fitted Model, Multiple Linear Regression and Certain, Nonlinear Regression Models, Linear Regression Model Using Matrices, Properties of the Least Squares Estimators.

**Course Outcomes:**

On successful completion of the course students will be able to:

|  |  |  |  |
| --- | --- | --- | --- |
| **CLO #** | **CLO Statement** | **Bloom’s Taxonomy** | **Associated PLO** |
| CLO 1 | Explain the basic concepts of probability and statistics used for data representation and sampling | C2 | PLO1 |
| CLO 2 | Apply basic statistical techniques and probability theory for decision making and for solving problems | C3 | PLO2 |
| CLO 3 | Compare various probabilistic and statistical analysis techniques and their usage in science and engineering | C4 | PLO2 |

**Week wise Course Breakup**

|  |  |  |  |
| --- | --- | --- | --- |
| **Week** | **From** | **To** | **Topics** |
| 1 | 18-Sep-2023 | 22-Sep-2023 | Introduction to Statistics and Data Analysis. Statistical Inference, Samples, Populations Role of Probability. |
| 2 | 25-Sep-2023 | 29-Sep-2023 | Measures of Location Measures of Variability. Graphical Methods and Data Description, Mean, Variance and Percentiles of Grouped Data. |
| 3 | 2-Oct-2023 | 6-Oct-2023 | Set theory, Set, Subset, Event. Counting Sample Points, Permutation and Combination. |
| 4 | 9-Oct-2023 | 13-Oct-2023 | Probability of an Event, Additive Rules, Conditional Probability, Independence, Product Rule and Bayes’ Rule |
| 5 | 16-Oct-2023 | 20-Oct-2023 | Random Variable: Concept of a Random Variable. Discrete Probability Distributions. Continuous Probability Distributions. |
| 6 | 23-Oct-2023 | 27-Oct-2023 | Random Variable: Joint Probability Distributions. Marginal Probability Distributions. Conditional Probability Distributions. |
| 7 | 30-Oct-2023 | 3-Nov-2023 | Mathematical Expectation: Mean, Variance and Covariance of a Random Variable. |
| 8 | 6-Nov-2023 | 10-Nov-2023 | Mathematical Expectation: Means of Linear Combinations of Random Variable. Chebyshev’s Theorem. |
| **9** | **10-Nov-2023** | **19-Nov-2023** | Midterm Examination |
| 10 | 20-Nov-2023 | 24-Nov-2023 | Discrete Probability Distributions: Uniform Distribution, Bernoulli Process. |
| 11 | 27-Nov-2023 | 1-Dec-2023 | Discrete Probability Distributions: Binomial and Multinomial Distributions, Hypergeometric Distribution. |
| 12 | 4-Dec-2023 | 8-Dec-2023 | Discrete Probability Distributions: Geometric Distribution, Poisson Distribution and Poisson Process |
| 13 | 11-Dec-2023 | 15-Dec-2023 | Continuous Probability Distributions: Uniform Distribution, Normal Distribution. Area Under the Normal Curve and Interpolation. |
| 14 | 18-Dec-2023 | 22-Dec-2023 | Continuous Probability Distributions: Normal Approximation to the Binomial. Gamma and Exponential Distributions |
| 15 | 25-Dec-2023 | 29-Dec-2023 | Continuous Probability Distributions: Chi-Squared Distribution and Lognormal Distribution |
| 16 | 1-Jan-2024 | 5-Jan-2024 | F-Quantile and Probability Plots. Single Sample & One and Two Sample Tests of Hypotheses, The Use of P-Values for Decision Making in Testing Hypotheses |
| 17 | 8-Jan-2024 | 12-Jan-2024 | Linear Regression and Correlation, Least Squares and the Fitted Model, Linear Regression Model, Using Matrices Properties of the Least Squares Estimators |
| **18** | **12-Jan-2024** | **24-Jan-2024** | Final Examinations |

***NOTE:***

*This schedule is subject to revisions as conditions may warrant. Topics will be covered in sequence no matter if city observes any planned or unplanned holidays. The information in this course outline is subject to revision as conditions may warrant.*

**Course Assessment Method**

**Method of Evaluation and Structure:**

A student’s grade will be based on multiple measures of performance as mentioned below:

|  |  |
| --- | --- |
| **Evaluation Instruments (EI)** | **Marks** |
| Quizzes (4 Quizzes of 10 Marks) | 10 |
| Assignments (4 Assignments) | 20 |
| Mid Term Examination | 20 |
| Final Examination | 50 |
| **Total** | **100** |

*NOTE: Any change in this scheme/format will be communicated well in time.*

**Grading System:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Letter Grade** | **Grade Point** | **Percentage** | |
| **A** | 4.0 | ≥ 85 | - |
| **A-** | 3.67 | ≥ 80 | < 85 |
| **B+** | 3.33 | ≥ 75 | < 80 |
| **B** | 3.00 | ≥ 71 | < 75 |
| **B-** | 2.67 | ≥ 68 | < 71 |
| **C+** | 2.33 | ≥ 64 | < 68 |
| **C** | 2.00 | ≥ 60 | < 64 |
| **C-** | 1.67 | ≥ 57 | < 60 |
| **D+** | 1.33 | ≥ 54 | < 57 |
| **D** | 1.00 | ≥ 50 | < 53 |
| **F** | 0.00 | - | < 50 |

**Mapping of CLOs to PLOs (Program Learning Outcomes)**

|  |  |  |  |
| --- | --- | --- | --- |
| **PLOs** | **CLO1** | **CLO2** | **CLO3** |
| PLO:1 (Engineering Knowledge) | x | x |  |
| PLO:2 (Engineering Problem Analysis) |  |  | x |
| PLO:3 (Designing and Development) |  |  |  |
| PLO:4 (Investigation) |  |  |  |
| PLO:5 (Modern tool usage) |  |  |  |
| PLO:6 (Engineer and Society) |  |  |  |
| PLO:7 (Environment and Sustainability) |  |  |  |
| PLO:8 (Professionalism and Ethics) |  |  |  |
| PLO:9 (Individual and Team Work) |  |  |  |
| PLO:10 (Communication) |  |  |  |
| PLO:11 (Project Management) |  |  |  |
| PLO:12 (Lifelong Learning) |  |  |  |

**COURSE RESOURCES**

**Instructor:**

**Name**: Dr. Muhammad Hussain

**Designation**: Senior Assistant Professor

**Office**: Faculty Room 6, New Engineering Block

**Email**: engr.m.hussain.bukc@bahria.edu.pk

**Recommended Books:**

**Text Book(s):**

* Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying E. Ye, (2014). Probability and Statistics for Engineers and Scientists (5th Edition). McGraw-Hill Education.

**Reference Book(s):**

* Anthony J. Hayter, Duxbury Press. (2016). Probability and Statistics for Engineers and Scientists (12th edition,). Cengage Learning.
* John Schiller, R. Alu Srinivasan and Murray Spiegel. Schaum's Outline of Probability and Statistics (6th Edition) McGraw-Hill Education.

**Online References:**

* [*https://www.mathsisfun.com/data/index.html*](https://www.mathsisfun.com/data/index.html)
* [*https://www.khanacademy.org/math/statistics-probability*](https://www.khanacademy.org/math/statistics-probability)
* [*https://stattrek.com/*](https://stattrek.com/)
* [*https://byjus.com/maths/probability-and-statistics/*](https://byjus.com/maths/probability-and-statistics/)