



COMSATS University Islamabad, Abbottabad Campus
Department of Mathematics

Course Plan-Semester Spring- 2023

Course Code: MTH 262

Course Title: Statistics & Probability Theory

Teacher: Laila

Class: BSE

Total Credit Hours: **03**

Lecture Credit Hours: **03**

Pre-requisite: Calculus

Text Books / Essential Reading:

1. *Introduction to Statistics*; Walpole, 3rd edition.
2. *Probability and Statistics for Engineers & Scientists*; Walpole, Myer and Myer, 9th edition.
3. *Probability and Random Processes for Electrical Engineers*; Alberto, Leon-Garcia. 2nd edition.
4. *Probability and Statistics for Engineering and the Sciences*. Jay L. Devore, 8th edition.
5. *Introduction to statistical theory (Part-I and II)*, Sher M. Chaudary

Course Objectives:

This course is primarily designed for engineering students. By the end of the course, the students should be able to

- explain basic statistical terminology, calculate and interpret descriptive statistics, including measures of central tendency and dispersion;
- construct frequency tables, draw, read and analyze basic charts and graphs;
- use statistical packages in analyzing data;
- Apply statistical procedures learnt in the course to some of their problems in engineering.

A primary objective of the course is also to introduce the fundamentals of Probability and Random Variables which ultimately lead to Stochastic Models used in electrical engineering. It also includes some application of inferential statistics and regression analysis that remain very useful for model selection and appropriate statistic selection.

Course Outline and Lecture Breakdown:

Week	Contents
1.	Introduction. Basic terminology-Population and Sample. Descriptive and Inferential statistics. Methods of collection of data. Ungrouped and grouped data; frequency distribution. Frequency curves. Problems.
2.	Summary Descriptive Measures-Measures of central tendency-sample mean median and mode for grouped and ungrouped data. Empirical relations. Problems. Geometric mean, Harmonic mean, Weighted mean and combined mean. Percentiles and Quartiles. Five numbers summary and its usefulness in real life application.

3.	Measures of dispersion-sample range, variance and standard deviation. Properties of the Mean and Variance. Real life application of these measures. Coding of Data Problems for mean and variance. Symmetry and Skewness. Use of S.D. Empirical Rule. Chebyshev's theorem. Z-Scores. Coefficient of Variation. Introduction to MINITAB and SPSS and Application.
4.	Probability. Random experiment, Classical and Relative frequency definitions of probability. Subjective Approach. Mathematical Approach. Sample Space. Event and types of Events. Set Function. Formation of Sample Spaces. Methods of formulation of sample space. Counting Techniques, Multiplication rule, Permutation and Combination, its application.
5.	Mathematical Definition of probability, Properties of Probability, probability of simple events. Applications to Problems. Addition Laws of probability for mutually exclusive and nonmutually exclusive events. Application to the problems.
6.	Definition of Conditional Probability, rule of Conditional Probability and its applications. Multiplication Rule of probability for independent and dependent events. Properties of independent events. Application to the problems.
7.	Theorem of Total Probability and Baye's Rule. Applications to Problems. Introduction to Random Variables, discrete and continuous random variables. Definition of Probability Mass function (pmf) and its properties. Definition of Cumulative Distribution Function (cdf) or Distribution Function (df) and its properties for Discrete random variable. Application to problems.
8.	Definition of Probability Density function (pdf) and its properties. Definition of Cumulative Distribution Function (cdf) or Distribution Function (df) and its properties for Continuous random variable. Application to problems. Definition of Bivariate discrete random variables, its Joints Probability Distributions, Marginal and Conditional Probability distributions, their properties and application to the problems.
9.	Mathematical Expectation of Discrete and Continuous random variables. Mathematical Expectation of Bivariate Discrete and Continuous random variables. Properties of Mathematical Expectation of Discrete and Continuous random variables.
10.	Variance of discrete and continuous random variables. Moments about mean and origin. Relation ship between Moments about mean and origin. Moment generating function. Chebyshev's theorem. Bernoulli trial, Bernoulli process, Bernoulli distribution. Binomial Experiment, Binomial Random Variable and Binomial Probability Distribution. Properties of Binomial Probability Distribution. Application to problems.
11.	Hyper geometric Experiment, Hyper geometric Random Variable and Hyper geometric Probability Distribution. Properties of Hyper geometric Probability Distribution. Application to problems. Hyper geometric Approximation to Binomial. Application to Problems. Negative Binomial Experiment, Negative Binomial Random Variable and Negative Binomial Probability Distribution. Properties of Negative Binomial Probability Distribution. Application to problems. Geometric Probability Distribution, its relationship with Negative Binomial Probability Distribution. Properties of Geometric Probability

	Distribution. Application to Problems.
12.	Poisson Experiment, Poisson Random Variable and Poisson Probability Distribution. Properties of Poisson Probability Distribution. Application to problems. Poisson Process and Application to Problems. Binomial Approximation to Poisson. Second Sessional Exam.
13.	Uniform Probability Distribution for Continuous random variable, its properties and application to problems. Normal distribution- definition, properties; standard normal distribution. Normal distribution. Application to Problems. Binomial approximation to Normal distribution. Application to problems.
14.	Exponential Probability Distribution, Gamma Probability Distribution and their Properties. Relationship between Exponential and Gamma Distribution, Weibull Probability Distribution and its properties. Applications to Problems.
15.	Statistical Inference, Confidence Intervals & Testing of Hypothesis. Applications to Problems.
16.	Introduction to Regression and correlation. Correlation Coefficient and its properties. Simple Linear Regression Model (SLRM). Method of estimation of SLRM (Ordinary Least Square Method OLS). Assumptions of OLS. Applications to Problems. Testing the Significance of Parameters and Confidence Intervals.

Assessment Scheme:

Attendance & Class Participation

Home assignments: 25%

Quizzes:

Midterm Examination: 25%

Final Examination: 50%

Total 100%

Attendance Policy: Students are allowed a maximum of two absences, and will not lose any marks for the first two absences; thereafter, 1(One) mark may be deducted for every absence (out of the 5 marks reserved for attendance and class participation). But in case of any emergency prior approval of instructor relaxation is possible.

Punctuality: The class timing should be followed strictly and late comers will not be entertained at any cost. Any student who is late for the class is liable to deduction of marks out of those reserved for attendance & class participation (will be adjusted in class assignments or final paper as per policy approved by department). Any student, who is late for more than 5 minutes, will be marked absent and student late more than 15 minutes will not be allowed to enter the classroom and should be marked absent. The students having any problems regarding their study are welcome but they are strictly not allowed to come in office.

Quiz/Assignment Policy: According to the policy of Mathematics Department, there two(2) quizzes and two(2) Assignments are scheduled. And this is minimum number of evaluation of tasks, according to the course the number of quizzes and assignments may increase but will be notify to all of the students through course portal. Students without book in the class will be marked as absent.

Self – Study & Class Preparation: Students are required to revise the material covered in class very soon after the class, and to attempt unsolved exercises / numerical problems so that they become well – versed in that topic. This is essential for a proper understanding of the course material. Students will be provided supporting material through course portal, and CU Portal will be the most reliable communication channel between students and teachers. Also students are expected to study the next few topics before the next lecture so that they may be able to understand the lecture in better manners.

Submission of Assignments: All assignments for formal evaluation must be submitted by the pre-announced date and through CR/GR. Only for very genuine reasons (with the prior permission from the instructor), the instructor may grant an extension for the submission of an assignment. Assignments not turned in by the due date will be liable to deduction of marks.

Academic Integrity: Academic honesty, integrity and discipline are expected from all of the students. Students who violate academic integrity in a quiz or an examination will fail that quiz / exam, and in case of misbehave with the instructor may have to go through strict disciplinary action as per University Policy.