

CNST-2430: ENGINEERING PROBABILITY AND STATISTICS

Cuyahoga Community College

Viewing: CNST-2430 : Engineering Probability and Statistics

Board of Trustees:

June 2026

Academic Term:

Fall 2026

Subject Code

CNST - Construction Engineering Tech

Course Number:

2430

Title:

Engineering Probability and Statistics

Catalog Description:

[Cross-listed with MET-2430. Credit can only be earned once for either course]. Course covers probability and statistics for engineers. Course topics include: measures of central tendency and dispersion, probability axioms and rules, standard discrete distributions, standard continuous distributions, point and confidence interval parametric values, central limit theorem, sampling distributions, hypothesis testing for one-sample and two-sample means and proportions, relationships between two random variables, correlation analysis, and simple linear regressions. Examples, problems, and case studies can be from manufacturing, mechanical, civil, electrical, and construction engineering.

Credit Hour(s):

3

Lecture Hour(s):

3

Requisites

Prerequisite and Corequisite

MATH-1610 Calculus I.

Outcomes

Course Outcome(s):

Calculate measures of central tendency and dispersion.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Summarize data in Stem-and-Leaf Diagrams, Histograms, Box Plot, Time Series Plots, and summarize Multivariate Data
2. Apply the Binomial Distribution and Poisson Distribution
3. Calculate Mean and Variance

Course Outcome(s):

Perform correlation analysis.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Apply Hypothesis Testing, calculate p-Value, and Errors
2. Perform Simple Linear Regression and Multiple Regression to engineering samples
3. Create Control Charts applicable to quality control in manufacturing

Course Outcome(s):

Perform simple linear regression.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Apply Hypothesis Testing, calculate p-Value, and Errors
2. Perform Simple Linear Regression and Multiple Regression to engineering samples

Course Outcome(s):

Know probability axioms and rules.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Apply the Binomial Distribution and Poisson Distribution
2. Calculate Mean and Variance
3. Create Control Charts applicable to quality control in manufacturing

Course Outcome(s):

Describe the shape, mean, and variance of standard discrete distributions.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Summarize data in Stem-and-Leaf Diagrams, Histograms, Box Plot, Time Series Plots, and summarize Multivariate Data
2. Define Random Variables and Probability
3. Apply the Binomial Distribution and Poisson Distribution
4. Calculate Mean and Variance
5. Create Control Charts applicable to quality control in manufacturing

Course Outcome(s):

Describe the shape, mean, and variance of standard continuous distributions.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Summarize data in Stem-and-Leaf Diagrams, Histograms, Box Plot, Time Series Plots, and summarize Multivariate Data
2. Define Random Variables and Probability
3. Apply the Normal Distribution, Lognormal Distribution, Gamma Distribution, Beta Distribution, and Weibull Distribution
4. Calculate Mean and Variance
5. Create Control Charts applicable to quality control in manufacturing

Course Outcome(s):

Estimate point and confidence interval parametric values.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Apply Hypothesis Testing, calculate p-Value, and Errors
2. Create Control Charts applicable to quality control in manufacturing

Course Outcome(s):

Explain and apply the central limit theorem.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Apply the Normal Distribution, Lognormal Distribution, Gamma Distribution, Beta Distribution, and Weibull Distribution
2. Apply the Binomial Distribution and Poisson Distribution
3. Calculate Mean and Variance

Course Outcome(s):

Analyze sampling distributions.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Apply the Normal Distribution, Lognormal Distribution, Gamma Distribution, Beta Distribution, and Weibull Distribution
2. Create Control Charts applicable to quality control in manufacturing

Course Outcome(s):

Conduct hypothesis testing for one-sample and two-sample means and proportions.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Apply Hypothesis Testing, calculate p-Value, and Errors
2. Create Control Charts applicable to quality control in manufacturing

Course Outcome(s):

Explain relationships between two random variables including dependence and joint distributions.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Apply the Normal Distribution, Lognormal Distribution, Gamma Distribution, Beta Distribution, and Weibull Distribution
2. Apply Hypothesis Testing, calculate p-Value, and Errors

Methods of Evaluation:

1. Assignments and projects
2. Quizzes and/or midterm examination
3. Final Examination

Course Content Outline:

1. General Introduction
 - a. Overview of statistical process and engineering
 - b. Types of engineering data
 - c. Differences between mechanistic and empirical model
2. Summarizing of Data and Presentation Approaches
 - a. Stem-and-leaf Diagram
 - b. Histograms
 - c. Box plot
 - d. Time series plots
 - e. Multivariate data
3. Continuous and Discrete Random Variables
 - a. Defining random variables
 - b. Defining probability density functions, cumulative distribution function, mean, and variance
4. Continuous Probability Distributions
 - a. Normal distribution
 - b. Lognormal distribution
 - c. Gamma distribution
 - d. Weibull distribution
 - e. Beta distribution
 - f. Plotting probability distribution
5. Discrete Probability Distributions
 - a. Binominal distribution
 - b. Poisson distribution
 - c. Approximation of binomial and Poisson distribution with normal distribution
 - d. Introduction to dependence/independence of variables
 - e. Central limit theorem
6. Decision Making, One and Two Samples
 - a. Point estimation
 - b. Hypothesis testing
 - c. Type II errors
 - d. Sample sizes
 - e. Confidence intervals
7. Regression Analysis Introduction
 - a. Least square estimation
 - b. Confidence intervals in regression analysis
 - c. Multiple regression and estimation of parameters
8. Design of Experiments Introduction
 - a. Strategy of experimentation
 - b. Factorial experiments
9. Statistical Quality Control Introduction
 - a. Introduction to quality control processes
 - b. Introduction to control charts
 - c. Measurement systems limitations

Religious Accommodation

Before reviewing the course schedule, students should carefully review the following religious accommodation policy and other required instructional policies:

Religious Accommodation:

Students seeking an accommodation for absences permitted under Ohio's Testing Your Faith Act must provide the instructor with written notice of the specific dates for which the student requires an accommodation and must do so not later than fourteen (14) days after the first day of instruction. Please submit requests for accommodations at this link: <https://portal2.tri-c.edu/ReligiousAccommodation/> Religious Accommodation Form. Students with questions about their religious accommodations under Ohio's Testing Your Faith Act may contact the College's Office of General Counsel and Legal Services by phone at 216.987.4856 or via email at legal@tri-c.edu.

Other Required Instructional Policies:

<https://www.tri-c.edu/student-resources/curriculum/documents/syllabus-part-b.pdf>

Weekly Schedule

	Topics
Week 1	- Course Overview: Objectives, grading, textbook, expectations. - Introduction to statistics in Engineering, Types of Engineering Data
Week 2	- Summarizing of Data and Presentation Approaches - Histograms, Stem-and-leaf Plots, Box Plots - Measures of Central Tendency and Variability
Week 3	- Probability Concepts - Basic Probability Rules - Conditional Probability and Independence
Week 4	- Continuous and Discrete Random Variables - Continuous Probability Distribution
Week 5	- Introduction to the Normal Distribution - The Normal Distribution & Central Limit Theorem - Standard Normal Distribution - CLT and its Engineering Implications
Week 6	- Discrete Random Variables - Binomial and Poisson Distributions - Expected Value and Variance
Week 7	Mid Term Exam Review and Mid Term Exam (Covers Weeks1-6)
Week 8	- Sampling and Estimation - Sampling Methods - Point Estimation and Confidence Intervals
Week 9	- Hypothesis Testing Basics - Null and Alternative Hypotheses
Week 10	- One-Sample Tests - Z-test and t-test for Means - Confidence Intervals Revisited
Week 11	- Analysis of Variance (ANOVA) - One-Way ANOVA - Assumptions and Interpretation
Week 12	- Linear Regression - Simple Linear Regression - Least Squares Estimation
Week 13	- Statistical Quality Control - Control Charts for Variables and Attributes
Week 14	- Design of Experiments (DOE) - Factorial designs - Randomization and Replication
Week 15	Final Exam Review (Covers Week 1-13)
Week 16	Final Exam

The Course Schedule is subject to change due to pedagogical needs, instructor discretion, parts of term, and unexpected events.

Required/Recommended Readings

Readings may be selected from the following supplemental resources:

Montgomery, D. C., & Runger, G. C. *Applied statistics and probability for engineers*.

Figliola, R. S., & Beasley, D. E. *Theory and design for mechanical measurements*.

Resources for the Instructor

Montgomery, Douglas C., George C. Runger, and Norma Faris Hubele. *Engineering Statistics*. 7th Edition. Hoboken, NJ: John Wiley, 2020.

Navidi, William Cyrus. *Principles of Statistics for Engineers and Scientists*. 2nd. Dubuque, IA: McGraw-Hill, 2021.

Chege, Paul. *Probability and Statistics*. 1st. OpenSource,

Figliola, R. S., & Beasley, D. E. . *Theory and design for mechanical measurements..* 7th. 2020.

Instructional Services

OAN Number:

Transfer Assurance Guide OES004

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