



Unit of Study Information

Code	Unit	Evaluation Method	Mode	Session options
MA70H	Probability and Statistics	Grade and Attendance	Presencial	Semestral

Workload					
TC	PC	OA	SPA	PACC	Total
4	0	4	0	0	60
<ul style="list-style-type: none">• TC: Theoretic Classes (per week);• PC: Practical Classes (per week);• OA: Out-of-class Activities (hours per session);• SPA: Supervised Practical Activities (classes per session);• PACC: Practical Activities as Curricular Components (classes per session, included in OA and SPA);• Total: total workload in hours.					

Learning Outcomes
Develop statistical reasoning and enable students to master statistical techniques, aiming at their application in the analysis and problem solving of science and engineering.

Syllabus
Descriptive statistics. Probability. Random Variable. Probability Distribution. Estimation. Confidence Interval. Hypothesis Test. Analysis of variance. Correlation and Regression Analysis. Statistical Process Control.

Content		
Order	Syllabus	Content
1	Descriptive statistics.	1.1 History and Concepts of Statistics. 1.2 Descriptive Statistics and Inferential Statistics. 1.3 Terminology: Population, Sample, Variable, Data, Census, Sampling. 1.4 Classification of Variables. 1.5 Types of Variables. 1.6 Phases of Statistical Survey and Pilot Research. 1.7 Raw Data and Ordered raw data. 1.8 Organization and Presentation of Data. 1.9 Types of Tables and Graphs. 1.10 Frequency Distribution at Intervals. 1.11 Minimum, Maximum, Amplitude, and Number of Classes. 1.12 Class Limits, Amplitude, and Midpoint. 1.13 Sample Amplitude and Total Amplitude. 1.14 Simple or Absolute Frequency and Relative Frequency. 1.15 Accumulated Frequency: Absolute and Relative. 1.16 Relative Frequency Density. 1.17 Frequency Histogram. 1.18 Relative Frequency Density Histogram. 1.19 Frequency Polygon. 1. 20 Accumulated Frequency Polygon: Warhead. 1.21 Measures of Central Trend: Mean, Median, Mode. 1.22 Types of Mean: Arithmetic, Geometric, Harmonic; Simple and Weighted. 1.23 Quantis and Quartiles. 1.24 Scatter Measurements: Amplitude, Mean Deviation, Variance, Standard Deviation, Coefficient of Variation. 1.25 Boxplot Chart and Outliers. 1.26 Form Classification: Asymmetry and Kurtosis. 1.27 Asymmetry Measures: Pearson's Asymmetry Coefficient. 1.28 Kurtosis Measurements: Kurtosis Coefficient. 1.29 Using Spreadsheets and Statistical Software. Standard Deviation, Coefficient of Variation. 1.25 Boxplot Chart and Outliers. 1.26 Form Classification: Asymmetry and Kurtosis. 1.27 Asymmetry Measures: Pearson's Asymmetry Coefficient. 1.28 Kurtosis Measurements: Kurtosis Coefficient. 1.29 Using Spreadsheets and Statistical Software.
2	Probability	2.1 Introduction: Concept and Purpose, Uncertainty, Possibility, Phenomenon, Experiment, Test, Model, Relationship between Probability Theory and Set Theory. 2.2 Terminology: Random Experiment, Sample Space, Sample Point, Event. 2.3 Types of Sample Space. 2.4 Event Types and Event Properties. 2.5 Probability Calculation Methods: Classic, Frequentist, Geometric. 2.6 Axiomatic Definition of Probability. 2.7 Probability Space. 2.8 Main Probability Properties. 2.9 Sum Theorem. 2.10 Conditional Probability. 2.11 Product Theorem. 2.12 Independent Events. 2.13 Total Probability Theorem. 2.14 Bayes theorem.
3	Random Variable.	3.1 Concept, Definition and Types of Random Variable. 3.2 Probability Function for Discrete Random Variable. 3.3 Probability Distribution Function for Discrete Random Variable. 3.4 Probability Density Function. 3.5 Probability Distribution Function for Continuous Random Variable. 3.6 Mathematical Expectation and Variance for Discrete Random Variable. 3.7 Mathematical Expectation and Variance for Continuous Random Variable. 3.8 Properties of Mathematical Expectation. 3.9 Properties of Variance.
4	Probability Distribution	4.1 Discrete Uniform Distribution 4.2 Bernoulli Distribution. 4.3 Binomial Distribution. 4.4 Hypergeometric Distribution. 4.5 Poisson Distribution. 4.6 Geometric Distribution. 4.7 Pascal Distribution. 4.8 Continuous Uniform Distribution. 4.9 Normal Distribution. 4.10 Gamma Distribution. 4.11 Exponential Distribution. 4.12 Weibull Distribution. 4.13 Student's T distribution. 4.14 Chi-Square Distribution. 4.15 Fisher F Distribution
5	Estimation	5.1 Concept and Purpose. 5.2 Terminology: Parameter, Statistics, Estimator, Estimation, Bias, Vice, standard error, Point Estimation and Interval Estimation, Random Sample. 5.3 Main Sampling Techniques; Sampling With and Without Replacement. 5.4 Probability Samples, Non-Probability Samples and Representative Samples. 5.5 Sample Distribution of Means and Theoretical Assumptions. 5.6 Central Limit Theorem. 5.7 Sample Distribution of Proportions. 5.8 Sample Distribution of Two Means Difference. 5.9 Sample Distribution of Two Proportion Difference. 5.10 Methods of Point Estimator Selection. 5.11 Properties of Estimators.
6	Confidence Interval	6.1 Confidence Intervals for Normally Distributed Population Parameters. 6.2 Confidence Interval for the Population Mean, with Known Variance. 6.3 Confidence Interval for Population Mean, with Unknown Variance. 6.4 Confidence Interval for the Difference of Two Population Mean, 6.5 Confidence Interval for Population Variance. 6.6 Confidence Interval for Population Proportion. 6.7 Confidence Interval for the Difference of Two Population Proportions. 6.8 Sample Size.
7	Hypothesis Test	7.1 Concept, Purpose and Terminology: Statistical Decision, Null Hypothesis, Alternative Hypothesis, Confidence Level, Significance Level. 7.2 Types of Errors and P-Value. 7.3 Power of the Test. 7.4 Regions of Acceptance and Rejection of the Null Hypothesis. 7.5 Hypothesis Test for the Population Mean, with Known Variance. 7.6 Hypothesis Test for the Population Mean, with Unknown Variance. 7.7 Hypothesis Test for Population Proportion. 7.8 Hypothesis Test for the Difference of Two Population Means, with Known Variances. 7.9 Hypothesis Test for the Difference of Two Population Means, with Unknown Variances. 7.10 Hypothesis Test for the Difference of Two Population Proportions. 7.11 Hypothesis Test for Population Variance. 7.12 Chi-Square Test for Adherence. 7
8	Variance Analysis	8.1 Variance Analysis: Concept and Purpose. 8.2 Terminology: Experiment, Treatment, Factor, Factor Levels, Experimental Unit or Plot, Repetition, Experimental Design 8.3 Types of Treatments: Quantitative and Qualitative. 8.4 Variance Analysis Theoretical Assumptions, Model and Hypotheses. 8.5 Statistical Tests to Validate Theoretical Assumptions of Variance Analysis. 8.6 Variance Analysis with a Factor. 8.7 Statistical Tests for Comparison of Means. 8.8 Two-Way Variance Analysis 8.9 Variance Analysis with Two Repeated Factors.
9	Correlation and Regression Analysis	9.1 Measures of Association between Two Variables, by Scale: Covariance and Correlation. 9.2 Scatter Diagram. 9.3 Regression Analysis: Concept and Purpose. 9.4 Terminology: Response or Dependent Variable, Explanatory or Independent Variable, Error, Residual. 9.5 Simple Linear Regression: Theoretical Assumptions, Linear Correction Coefficient or Pearson's Coefficient, Least Squares Coefficient Estimation Method, Simple Linear Model, Determination Coefficient, Residue Analysis. 9.6 Polynomial Model. 9.7 Exponential Model. 9.8 Logarithmic Model. 9.9 Power Model.
10	Statistical Process Control	10.1 Statistical Process Control : Concept, Purpose, and Terminology. 10.2 Control Chart for Mean and Amplitude. 10.3 Control Chart for Mean and Standard Deviation. 10.4 Process Capacity Indexes. 10.5 Control Chart of the Number of Non-Conforming Units. 10.6 Control Chart of the Ratio of Non-Conforming Units. 10.7 Control Chart of the Number of Nonconformities in the Sample. 10.8 Control Chart of the Number of Nonconformities per Unit.

Basic Resources
MONTGOMERY, Douglas C.; RUNGER, George C. Estatística aplicada e probabilidade para engenheiros. 5. ed. Rio de Janeiro, RJ: LTC, 2012. xvi, 523 p. ISBN 9788521619024.
MAGALHÃES, Marcos Nascimento; LIMA, Antônio Carlos Pedroso de. Noções de probabilidade e estatística. 7. ed. São Paulo: Edusp, 2011. xiv, 408 p. ISBN 9788531406775.
MEYER, Paul L. Probabilidade: aplicações à estatística. 2. ed. Rio de Janeiro, RJ: LTC, 1983. xviii. 426 p. ISBN 8521602944.

Aditonal Resources
BERENSON, Mark L.; STEPHAN, David; LEVINE, David M.; KREHBIEL, Timothy C. Estatística: teoria e aplicações usando Microsoft Excel em português. 6. ed. Rio de Janeiro, RJ: LTC, 2012. xxv,804 p. ISBN 978852161620198.
MAGALHÃES, Marcos Nascimento. Probabilidade e variáveis aleatórias. 3. ed. São Paulo, SP: EDUSP, 2011. iv, 411 p. ISBN 9788531409455.
LARSON, Ron; FARBER, Betsy. Estatística aplicada. 4 ed. São Paulo: Pearson Prentice Hall, c 2010. 637 p. ISBN 9788576053729.
CCOSTA NETO, Pedro Luiz de Oliveira. Estatística. São Paulo, SP: E. Blücher, 2002. 266 p. ISBN 8521203004.
DEVORE, Jay L. Probabilidade e estatística: para engenharia e ciências. São Paulo, SP: Pioneira Thomson Learning, c2006. xiii, 692 p. ISBN 9788522104598.