



PONTIFICAL CATHOLIC UNIVERSITY OF RIO DE JANEIRO
CENTER OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF INDUSTRIAL ENGINEERING

IND2629 PROBABILITY AND STATISTICS

TOTAL HOURS: 45 HOURS

CREDITS: 3 – CRITERIA: 12

REQUIREMENTS(S): None

GOALS	To present (review and consolidate) concepts aimed at enabling the student to model and solve problems, develop probabilistic models, and perform data analysis with critical thinking. Additionally, to present all the basic elements of probabilistic modeling/probability theory and fundamental tools for statistical inference, in order to equip the student to independently expand their knowledge when more comprehensive and/or specific methods are needed.
SYLLABUS	Probability: Axioms and theorems. Conditional probability. Independence. Random variables. Main probability distributions. Random vectors: joint, marginal and conditional distributions. Covariance, correlation. Independence of random variables. Function of random variables. Central Limit Theorem. Estimation. Confidence Intervals. Prediction intervals. Hypothesis testing. Linear Regression. joint, marginal and conditional distributions. Covariance, correlation. Conditional expected values.
PROGRAM	Probability: axioms and theorems. Conditional probability. Independence. Random variables, probability mass function, probability density function, probability distribution. Continuous and discrete distributions. Random vectors. Independence of random variables. Function of random variables. Central Limit Theorem. Estimation: Sampling, estimators and properties. Estimation methods. Sampling distribution. Confidence interval: estimation, sample size calculation. Prediction intervals. Hypothesis testing: concept, estimation, type I and II errors, sample size, p-value. Linear regression: simple, multiple, analysis and diagnostic of model residuals.
BIBLIOGRAPHY	Montgomery, D. C.; Runger, G. C. Applied Statistics and Probability for Engineers. 7 th , Ed., Rio de Janeiro: LTC Editora, 2021. Casella, G.; Berger, R. L. Statistical Inference. 2 nd , Ed., Hardcover. 2001. Barnett , A. I. Applied Statistics: Models and Intuition. 1 st , Ed., Walth: Dynamic Ideas LLC, 2015.

**ADDITIONAL
REFERENCES**

Harrell Jr., F. E. Regression Modeling Strategies: With Applications to Linear Models, Logistic and Ordinal Regression, and Survival Analysis. 2nd, Ed., New York: Springer, 2015.

Hernán, M. A.; Robins, J. M. Causal Inference: What If, 1st, Ed., Florida: Chapman & Hall/CRC, 2020.

Ross, S. M. First Course in Probability, A., 10th, Ed., Pearson Education Limited, 2019

Gupta, B. C.; Guttman, I. Statistics and Probability with Applications for Engineers and Scientists Using MINITAB, R and JMP, 2nd Edition; New Jersey: Wiley, 2020.

Devore, J. L. Probability and Statistics for Engineering and the Sciences, A. 9th, Ed, São Paulo: Cengage Learning, 2015