



PONTIFICAL CATHOLIC UNIVERSITY OF RIO DE JANEIRO
CENTRE OF SCIENCE AND TECHNOLOGY
DEPARTAMENT OF INDUSTRIAL ENGINEERING

IND 2621 OPTIMIZATION UNDER UNCERTAINTY

TOTAL HOURS: 45

CREDITS: 3/CRITERIA 12

REQUIREMENTS(S): LINEAR PROGRAMMING, PROBABILITY AND STATISTICS

GOALS	Introduce concepts and methods for handling optimization problems with uncertain coefficients. State-of-the-art techniques are presented through practical applications of theoretical developments and computational tools.
SYLLABUS	Introduction to optimization under uncertainty; two-stage stochastic programming; multistage stochastic programming; risk averse optimization; probabilistic constraints; robust optimization; adjustable robust optimization; distributional robust optimization.
PROGRAM	<p>Introduction to optimization under uncertainty</p> <ul style="list-style-type: none">- Farmer and newsvendor problems- Value of stochastic solution and value of information <p>Two-stage-stochastic programming</p> <ul style="list-style-type: none">- Sample average approximation- Benders decomposition- Partition refinement methods <p>Multistage stochastic programming</p> <ul style="list-style-type: none">- Scenario tree representation- Filtration interpretation of non-anticipation constraints- Stochastic Dual Dynamic Programming <p>Risk averse optimization</p> <ul style="list-style-type: none">- Mean-risk models- Coherent and convex risk measures in optimization models- Dynamic risk measures and time consistency- Probabilistic constraint <p>Robust optimization</p> <ul style="list-style-type: none">- Definition of uncertainty sets- Dual reformulation and oracle-based algorithms- Adjustable robust optimization <p>Distributional robust optimization</p>

- BIBLIOGRAPHY** SHAPIRO, A.; DENTCHEVA, D.; RUSZCZYNSKI, A. Lectures on Stochastic Programming: Modeling and Theory (Second Edition), MOS-SIAM Series on Optimization, 2014.
- BEN-TAL, A.; EL-GHAOU, L.; NEMIROVSKI, A. Robust Optimization, Princeton University Press, 2009.
- BIRGE, J.R.; LOUVEAUX, F. Introduction to Stochastic Programming (Second Edition), Springer Series in Operations Research and Financial Engineering, 2011.
- ADDITIONAL REFERENCES** RUSZCZYNSKI, A.; SHAPIRO, A. Stochastic Programming Models, Handbooks in Operations Research and Management Science, Elsevier, Volume 10, 2003.
- PETER, K.; MAYER, J. Stochastic Linear Programming: Models, Theory, and Computation. Springer, 2005.