TEL 603E – Introduction to Convex Analysis

Fall 2012

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References : J.-P. Hiriart-Urruty, C. Lemaréchal, 'Fundamentals of Convex Analysis', Springer, 2001.
S. Boyd, L. Vandenberghe, 'Convex Optimization', Cambridge University Press, 2004.
R. T. Rockafellar, 'Conjugate Duality and Optimization', SIAM, 1987.
C. Cerit, 'Lineer Programlama', 1996.

Grading : Homeworks and Project (30%), 1 Midterm (30%), Final (40%).

Tentative Course Outline

- Review of Linear Algebra (1 Week)
  Vector spaces, subspaces, basis, dimension, orthogonality, eigen analysis.
- Convex Sets (2 Weeks)
  Operations that preserve convexity of sets, convex/affine hulls, projections, separation, tangent and normal cones.
- Convex Functions (2 Weeks)
  Epigraph, Jensen's inequality, operations preserving convexity of functions, first and second order differentiation, conjugate functions.
- Duality (2 Weeks)
  Saddle point duality, Lagrange multipliers, the dual problem, Slater's condition.
- Subdifferentials (1 Week)
  Different geometrical interpretations, calculus rules on subdifferentials, monotone operators
- Linear Programming (The Simplex Method) (1 Week)
- Applications and Some Iterative Algorithms (4 Weeks)
  The augmented Lagrangian, ADMM, variational problems, POCS, Dykstra's algorithm, forward-backward algorithm, Douglas-Rachford algorithm, majorization-minimization, support vector machines...