# Global Optimization final exam topics 2023

## Deterministic algorithms, some global optimization problem classes

**Line search methods:** Descent direction, step size, general form of line search methods, steepest descent direction, Wolfe condition, strong Wolfe condition, Goldstein condition, rate of convergence, Zoutendijk theorem.

**Convexity:** Convex functions with extended real values, indicator function, epigraph, characterization of convex functions, minima of convex functions, regularity properties of convex functions, characterization of differentiable convex functions, Fenchel conjugate, biconjugate, theorem of Hiriart-Urruty, subgradient, subdifferential, approximate subdifferential and its application in optimization.

**Conjugate gradient method:** Residual, conjugate system of directions, conjugate directions method and the corresponding theorems, conjugate gradient method, rate of convergence.

**D.C. optimization:** D.C. function, D.C. optimization problem, D.C. classes, D.C. functions constitutes a dense set in the class of continuous functions, localizability, examples for D.C. optimization problems, ~~Tikhonov's theorem, canonical form of D.C. problems, transformation theorem.~~

## Metaheuristic algorithms

**Simulated Annealing:** The Metropolis algorithm and the physical phenomena which inspired it. What corresponds to the objective function? What are the main steps of the algorithm? Which step makes possible to jump out from local minima. The convergence of the algorithm. Application: Travelling salesman problem.

**Colony Optimization Algorithm::** The natural phenomenon that inspired it. The main steps of the algorithm. Which step makes possible to jump out from local minima. Application: Travelling salesman problem.

**Swarm Optimization Algorithm:** The natural phenomenon that inspired it. Which step makes possible to jump out from local minima. Give an example where this algorithm can be used.

**Genetic Algorithm:** Which natural phenomenon inspired it. Basic concepts of the algorithm and their connection to the optimization problem. The main steps of the algorithm. Give an example where this algorithm can be used.