## **NDSE 303: Operation Research II Nonlinear Models (3 credits)**

This course focuses on nonlinear programming, optimization in one variable, convexity, unconstrained and constrained optimization in many variables, Kuhn-Tucker optimality conditions, direct search and gradient methods, computational complexity, and major heuristic approaches, such as simulated annealing, neural networks, tabu search, and genetic algorithms.

***Prerequisites:*** *NDSE 202*

**Course Learning Outcomes:**

By the end of the course, students will be able to:

A1. Understand and identify engineering applications of nonlinear programming in operation research.

A2. Express real life engineering problems as mathematical nonlinear models and solve them

B1. Identify, formulate, and solve engineering problems

B2. Develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions

B3. Identify engineering applications of nonlinear programming

C1. Work effectively as a member/leader of a team to complete a pre-defined project.

**Course Learning Materials:**

* Taha, Hamdy. Operations Research: An Introduction, 10th edition. Prentice Hall International Edition
* Operations Research (Application and Algorithms) Wayne L. Winston 4th edition
* Frederick Hillier and Gerald Lieberman (2015), Introduction to Operations Research, 10th edition, McGraw Hill.

**Course Content:**

1. Linear Vs Nonlinear Models: an introduction into the applications and Motivations
2. Integer Programming
3. Optimization in One Variable
4. Convexity
5. Unconstrained Optimization with Several Variables
6. Constrained Optimization
7. The Method of Steepest Ascent (Descent)
8. Kuhn-Tucker Optimality Conditions
9. Goal, and multi-objectives
10. Major heuristic approaches