NATIONAL UNIVERSITY OF ENGINEERING

COLLEGE OF SCIENCES

MATHEMATICS PROGRAM

CM224 – INTRODUCTION TO CONVEX ANALYSIS

I. GENERAL INFORMATION

CODE	: CM224 Introduction to Convex Analysis
SEMESTER	: 4
CREDITS	: 4
HOURS PER WEEK	: 6 (Theory – Practice – Seminar)
PREREQUISITES	: CM211 Differential Calculus and Advanced Integral
	CM261 Linear Algebra I
CONDITION	: Mandatory

II. COURSE DESCRIPTION

Study convex analysis as a fundamental tool for linear and non-linear optimization courses, in finite dimension. Develop the convex analysis from the geometrical point of view.

III. LEARNING UNITS

1. Convex Sets

Definition of convex sets / Geometrical properties of convex sets / Convex capsule of sets / Hyperplanes. Polyhedra / Caratheodory Theorem / Topological properties / Extreme points / Krein Milman's Theorem / Asymptotic cones and their properties.

2. Convex Functions

Definition of convex function. Convex functions / Properties / Strictly convex functions / Strongly convex functions / Differentiable convex functions / Asymptotic functions.

3. Conjugation and Sub-differentiability

Separation theorems, polar cones / Conjugated functions and properties / Indicator function and a set support / Sub-differential of a convex function / Directional derivatives of a convex function.

4. Semicontinuity

General notions about multi-applications / Lower semicontinuity of multi-applications / Superior semicontinuity of multi-applications / Painleve-Kuratowski convergence /

Definition of multi-applications monotony / Monotony of the convex functions subdifferential / Continuity of the convex function subgradient.

IV. BIBLIOGRAPHY

- Rockafeller T. R, Convex Analysis, Princeton University Press, 1970.

- Crouzeix, Ocaña and Sosa, Análisis convexo, Monografías del IMCA, 2003.

- Hirriart-Urruty-Lemarechal, Convex Analysis and Minimization Algorithms Springer-Verlag, 1994.