NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF SCIENCES
COMPUTER SCIENCE PROGRAM

CM131 – DIFFERENTIAL CALCULUS

I. GENERAL INFORMATION

CODE	**:**	CM131 Differential Calculus
SEMESTER	**:**	1
CREDITS	**:**	5
HOURS PER WEEK	**:**	6 (Theory – Practice)
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

The course prepares students in the understanding and application of one-dimensional calculus for analyzing and solving engineering problems. The concepts of limits, continuity of real functions, derivatives of real functions and their applications in function approximation and drawing, computation of change rates, and solution of optimization problems are analyzed. The course focus on both, clear understanding of concepts and correct application of methods for solving engineering problems.

III. COURSE OUTCOMES

1. Identify the scientific character of Mathematics and appraise the rigor and objectivity of the discipline.
2. Recognize the fundamental theorems of Mathematics and apply them into specific and real problematic situations thoroughly.
3. Understand the concept of limit of a function, as well as the concept of continuity and apply them to analyze diverse problems.
4. Understand the concept of derivative as a basic tool in the study of Mathematics and its engineering applications.
5. Model optimization problems and solve them to find the optimal solution and analyze its characteristics and properties.
6. Draw functions of a real variable analyzing their behavior in different ranges.

IV. COURSE CONTENTS

1. LIMITS AND CONTINUITY OF REAL FUNCTIONS

Limits of real functions: properties / Calculus of algebraic and trigonometric limits / Lateral limits / Limits involving the infinity: theorems / Indefinite limits and limits at infinity / The number e as a limit / Asymptotes / Continuity of functions: in a point, in an interval / Properties / Bounded function / Extreme value theorem / Zero theorem.

2. DERIVATIVE OF REAL FUNCTIONS

Derivative: geometric interpretation of the derivative / Tangent and normal line / Derivative rules / Rule of the chain: derivative of trigonometric functions / Derivatives of the exponential and logarithmical functions / Derivative of higher order / Implicit derivative / Increasing and decreasing functions / Local maximums and minimums: the second derivative test for extreme

values calculus / Concavity and inflection points / Graphical representations of functions / Maximum and minimum problems.

3. APPLICATIONS OF DERIVATIVES

Derivative as an instantaneous change rate / Instantaneous velocity and acceleration / De Rolle Theorem and Mean Value Theorem / Criteria of first and second derivatives for relative extreme values / Concave functions and inflexion points / Application of maximum and minimum / L'Hospital rule.

4. FINITE DIFFERENCES

Definition / Table of differences / Interpolation / Differences of elemental functions / Polynomials generating n-order differences

V. METHODOLOGY

The course takes place in theory and practice sessions. In theory sessions, the instructor presents the concepts, theorems and applications. In practice sessions, different kinds of problems are solved and the solutions are analyzed. Active participation of students is encouraged in all sessions.

VI. GRADING SYSTEM

The Final Grade (PF) is calculated with the following formula:

PF = (EP + EF + PP) / 3

ME: Mid-term exam EF: Final Exam
PP: Average of quizzes

VII. BIBLIOGRAPHY

1. **LARSON – HOSTETLER**
   Differential and Integral Calculus
   Mc Graw Hill, Ed., 2012, Mexico
2. **ROSS L. FINNERY**
   Single Variable Calculus
   Prentice - Hall, Ed., 2010, Mexico