NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF ECONOMICS AND STATISTICAL ENGINEERING
STATISTICAL ENGINEERING PROGRAM

EC314 – ADVANCED CALCULUS

I. GENERAL INFORMATION

CODE	**:**	EC314 Advanced Calculus
SEMESTER	**:**	3
CREDITS	**:**	4
HOURS PER WEEK	**:**	5 (Theory – Practice)
PREREQUISITES	**:**	EC214 Integral Calculus
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

This theoretical and practical course has the objective of providing students with the necessary criteria and methods to model, analyze, and solve physical, geometric and optimization problems. The content of this course is divided in five learning units and encompasses the following subjects: Vectorial functions, curves, function of several variables, directional and partial derivatives, double and triple integral, line and surface integral, Stokes' theorem and gauss' theorem, first and second order differential equations.

III. COURSE OUTCOMES

1. Acknowledge the scientific nature of mathematics and assess its rigor and objectivity.
2. Analyze fundamental theorems of mathematics and rigorously apply them to situations with specific problems.
3. Interpret the concept of vectorial function and apply it to calculate limits, derivatives and integrals and assess its importance in the solution to engineering problems.
4. Understand the concept of real function of several variables and apply it to calculate limits, partial derivatives, double and triple integrals.
5. Define and calculate line, divergence and rotational integrals and assess its importance in the solution to engineering problems.
6. Identify the type, order and degree of an ordinary differential equation and apply solution methods in each case.

IV. LEARNING UNITS

1. VECTORAL FUNCTIONS / 10 HOURS
Vectorial functions: Limits, continuity, derivatives, integrals, arc length / Fundamental vectors: tangent, Norman and binormal vectors / Fundamental planes: osculating, normal and rectifying plane.

2. FUNCTIONS OF SEVERAL VARIABLES / 15 HOURS
Real function of several variables: limits, continuity. Partial derivate / Directional and gradient derivatives, tangent plane. Chain rule, implicit derivate / Second derivate criterion. Maxima and minima / Lagrange multiplier applied to conditioned problems / Double integrals: definition, change of variable in double integrals. Double integral in polar coordinate systems.

3. DOUBLE AND TRIPLE INTEGRALS / 15 HOURS
Double integrals: definition, change of variable in double integrals. Double integral in polar coordinates system / Center of mass / Moments of inertia / Triple integral – volume / Change of variables in triple integrals.

4. LINE INTEGRALS / 15 HOURS
Line integrals. Path-independent line integral. Work. Green's theorem / Surface area. Surface integral of the curl / Divergence of a vector field. Flow of vector fields / Tokes' theorem. Gauss' theorem. Applications.

5. ORDINARY DIFFERENTIAL EQUATIONS / 15 HOURS
Ordinary differential equations: order and degree / Equation with separable variables, equations with exact variables / Linear, homogeneous and Bernoulli differential equations / Application: Exponential growth and decay / Second order differential equations with homogeneous and non homogeneous constants / method of undetermined coefficients. Application: Orthogonal trajectories.

VI. METHODOLOGY

This course is carried out through theory and practical sessions. In theory sessions, the instructor introduces concepts, theorems and applications. In practical sessions, several problems are solved and their solution is analyzed. In all sessions, students' active participation is encouraged.

VII. EVALUATION FORMULA

The average degree PF is calculated as follows:

PF = (EP + EF + (P1+P2+P3+P4)/3) / 3

EP: Mid-Term Exam EF: Final Exam
P#: Quizzes

VIII. BIBLIOGRAPHY

1. **STEWARD, JAMES**
   Multivariate calculus (Spanish)
   I.T.E. Editorial, (2009)

2. **APOSTOL, TOM**
   Calculus Volume II
   Reverté Editorial (2008)