Curriculum:	Mathematical Analysis II	**Code**	93.28
Credits:	6		
Department	Exact and Natural Sciences	**Version**	2019

Course: Computer Science Engineering

Curriculum: S10 A - Rev18, S10-Rev23, S10 - Rev18

Objectives:

No.	Description
1	As a continuation of the Analysis I course where the concepts of limit, continuity, derivation and integration for functions of 1 variable were studied, students will have to achieve a thorough understanding of these concepts in functions of several variables. They should understand the concepts of Physics that gave rise to these concepts, solving problems such as the determination of masses, volumes and barycentres and moments of inertia of bodies in 1, 2 and 3 dimensions (such as wires, plates and solids in R^3)s. They should have a good understanding of the concept of linear approximation and know how to study the growth of functions, as well as how to solve simple optimization problems. Another objective of the subject is for the student to be able to visualize bodies in three dimensions and draw them in two dimensions, which will facilitate the resolution of problems in the calculations mentioned above.

Contents:

Functions of several variables. Extremum of functions of several variables. Integration. Implicit function theorems. Functions defined by integrals. Vector functions. Green's theorem. Stokes' theorem. Divergence theorem. Second order ordinary differential equations.

Required bibliography:

No.	Description
1	N/A. Vector Calculus. - MARSDEN-TROMBA. Inter-American Educational Fund. N/A, 0 N/A. Calculus vol. II - Tom Apóstol – Ed. Reverté. N/A, 0

Optional bibliography:

No.	Description
1	No optional bibliography has been uploaded.
2	No optional bibliography has been uploaded.

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Course transcript:

No.	Description
1	**Differential calculus in scalar and vector fields.** Open balls & open and closed sets. Interior, isolated, accumulation and boundary points. Scalar functions of 2 variables. Definition of a scalar function graph. Double limit. Definition and properties. Radial limits. Continuity. Definition and properties. Partial and directional derivatives. Differentiability. Vector functions. Limit continuity, derivative and differentiability. Composite function. Chain rule for derivatives of scalar and vector fields. Implicit functions. Tangent plane. Gradient of scalar functions. Properties. Level sets. Classification of surfaces. Derivative of implicitly defined functions. Maxima, minima and saddle points. Stationary point. Hessian matrix. Conditional extremes. Lagrange multiplier methods
2	**Double and triple integrals** Definition of the integral over rectangles and cubes. Null sets. Extension of the definition to more general sets. Study of the required continuity hypotheses. Properties. Change of variables. Cylindrical and spherical polar coordinates. Linear transformations. Calculation of volumes, first and second order moments, mass, barycentres.
3	**Integration.** Double Integral. Properties of a double integral. Iterated integrals. Transformations in the plane and change of variable in a double integral. The triple integral. Change of variable. Applications.
4	**Plane and Space Curves** Definition. Reparameterizations. Arc length. Vector operators. Gradient, divergence, rotor. Potential function.
5	**Functions defined by integrals.** Functions defined by integrals. Derivative under sign (of integration). Functions defined by improper integrals.
6	**Line integrals for vector and scalar fields** Definition. Applications: mass, barycentre, work. Area of a fence. Line integrals for vector fields: work of a force field on a particle, circulation of a velocity field. Path independence. Fundamental calculus theorems for line integrals. Green's theorem and extension of the theorem to manifold-connected sets. Necessary and sufficient condition for the existence of a potential function.
7	**Parametric Surfaces** Parametric Surfaces Tangent plane. Orientable surfaces. Normal vector field. Reparameterization. Surface integrals for vector and scalar fields Area of a surface. Calculation of first and second order moments, mass, barycentres. Flow of a vector field through a surface. Stokes and Gauss theorems. Geometrical and physical interpretation of rotor and divergence. Flow lines of a vector field **Ordinary differential equations.**

8	Liptchitz condition, Picard's theorem, Loneloff, first order equations, exact homogeneous functions, integrating factor, first and second order linear, variation of parameters, Wronskian, linear and nonlinear decoupling dynamical systems. -

Practical assignments:

No.	Description

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No.	Description
1	* Each course has an associated practical work where specific problems are developed from what has been explained in the course. This subject involves no laboratory practical work.

Laboratory assignments:

No laboratory assignments

Professor in charge:	Álvarez, Adrián Omar
Head of Department:	Stripeikis, Jorge Daniel