COURSE NAME

Name: **MATHEMATICS II**
Code: 101121
Curriculum: **DEGREE IN CIVIL ENGINEERING** Year: 1
Name of the module to which it belongs: BASIC TRAINING MODULE
Subject: MATHEMATICS
Nature: BASIC Duration: SECOND SEMESTER
ECTS Credits: 6 Classroom hours: 60
Face-to-face classroom percentage: 40% Non-contact hours: 90
Online platform: www3.uco.es/moodle/

FACULTY DETAILS

Name: RIOS LOPEZ, FCO. JAVIER DE LOS
(Coordinator)
Centro: EPS BÉLMEZ
Department:
MATHEMATICS
Area: APPLIED
MATHEMATICS
Location of the office: EPS BÉLMEZ
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SKILLS

CB4	Solve problems within the study area of Civil Engineering.
CEB1	Ability for solving mathematical problems that may arise in Engineering. Skills for applying knowledge on: linear algebra, geometry, numerical methods, numerical algorithms, statistics and optimisation.

OBJECTIVES

This course is aimed at, on the one hand, allow students to continue acquiring certain clear reasoning structures, which in turn allow them to apply the usual techniques to engineering.

On the other, it is aimed at allowing students to acquire and handle basic principles of Integral calculus of variables: Indefinite integral, definite integral, improper integrals, integral applications, we continue with Infinitesimal calculus of several variables: Representation, limits, continuity, differentiation and integration.

We continue with an introduction to Ordinary differential equations, followed by a basic introduction to Differential equations in partial derivatives.

Below we will do an introduction to Numerical methods, with their application to equation solving. Finally, we will discuss certain basic notions of Differential Geometry, regarding plane and spatial curves.

CONTENTS:

1. Theoretical contents

BLOCK I INTEGRATION INTO A VARIABLE

UNIT 1. INDEFINITE INTEGRAL. METHODS OF INTEGRATION

Introduction. Basic definitions. Properties. Immediate integrals. Elementary integration methods.

UNIT 2. DEFINITE INTEGRAL

Introduction. Concept of Definite Integral, as defined by Riemann. Properties. Integrability of Monotonous and Continuous Functions. Mean value theorem. Integrals as a Function of one Interval endpoint. Primitives. Calculation of Definite Integrals. Barrow's rule.

UNIT 3. IMPROPER INTEGRALS

Introduction. Improper integrals. Convergence and Calculus.

UNIT 4. APPLICATION OF DEFINITE INTEGRALS

Introduction. Modelling of problems that may be solved by integral calculation: Geometric and economic applications.

BLOCK II DIFFERENTIAL CALCULUS IN RN

UNIT 5. FUNCTIONS OF SEVERAL VARIABLES: LIMITS AND CONTINUITY

Introduction. Basic definitions. Level curves. Graphic of a two-variable function. Limits and continuity. Uniform continuity.

UNIT 6. DIFFERENTIATION OF SEVERAL-VARIABLE FUNCTIONS:

Introduction. Partial derivatives. Properties. Gradient of a scalar field. Derivative of a scalar field with respect to a vector. Directional derivatives, differentiability and total derivative. Geometrical interpretation. Properties. Chain rule for scalar field derivatives. Applications Mean value theorem. Sufficient differentiability condition. Partial derivatives of higher order. Taylor's formula for real functions and for scalar fields. Local end points. Criterion of the second derivative. Conditional end points. Lagrange's Multipliers. Absolute end points.

BLOCK III INTEGRAL CALCULUS IN RN

UNIT 7 MULTIPLE INTEGRALS

Introduction. Double integral. Change of variables. Applications Triple integral. Change of variables.

BLOCK IV DIFFERENTIAL EQUATIONS

UNIT 8 DIFFERENTIAL EQUATIONS

Introduction. Main concepts. Cauchy problem. Solving of EDOs Modelling of problems through the studied EDOs.

UNIT 9. DIFFERENTIAL EQUATIONS IN PARTIAL DERIVATIVES

Introduction and basic definitions. Obtaining EDDP by elimination of arbitrary functions. Quasi-linear equation of first order in partial derivatives: Characteristic curves, characteristic system, general solution.

BLOCK V NUMERICAL METHODS

UNIT 10. STUDY OF ERRORS

Definitions, sources of error. Estimation and dimensioning: Propagation of errors of data and in calculations, backward analysis of error.

UNIT 11. NUMERICAL METHODS FOR EQUATION SOLVING

Introduction. Iterative methods for approximation of solutions. Convergence order and *asymptotic* constant of error. Methods for acceleration of convergence.

BLOCK VI DIFFERENTIAL GEOMETRY

UNIT 12. PLANE CURVES

Speed vector. Regular curves. Tangent lines and normal lines. Frenet dihedral. Curvature. Frenet formulas.

UNIT 13. SPACE CURVES

Trihedral and Frenet formula. Curvature and twist.

2. Practical contents.

Solving exercises and problems related to theoretical contents.