ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S3*

IDENTIFICATION

Course code :	E2CP3B6
ECTS :	1

DURATION

Lectures :	8
Tutorial classes :	12
Labs :	0
Total :	20

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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UE : BATIMENT-ENERGIE

COURSE : Math for BE

SCOPE OF THE COURSE

OBJECTIVES

- **Double integrals** : definition, Fubini's theorem, change of variables, Jacobian, polar coordinates; applications : center of mass, moment of inertia, area calculation, volume under a surface
- **Triple integrals** : definition and applications, cylindrical and spherical coordinates, change of variables with the Jacobian, practical applications
- **Curves and line integrals** : curves and parametric equations, polar coordinates, definition and calculation of line integrals, applications to vector fields and curve length calculations
- **Fundamental theorems** : Green–Riemann theorem, Ostrogradski's and Stokes' theorems, gradient and curl theorems, calculation of the flux of a vector field

COMPETENCE AND SKILLS

- Formulate and evaluate double and triple integrals in Cartesian coordinates
- Formulate and evaluate line integrals in various geometric configurations
- Perform change of variables in multiple integrals (polar, cylindrical, and spherical coordinates)
- Apply multiple integrals to physics and engineering problems (volume, center of mass, moment of inertia calculations, etc.)
- Apply line integrals to physics problems (curve length, work done by a force, flux of vector fields, etc.)
- Use the Green–Riemann theorem and other fundamental theorems to solve physical and geometric problems

PROGRAM

1. Double and triple integrals in Cartesian coordinates : definition, geometric interpretation, calculation over simple domains.
2. Change of variables in multiple integrals : introduction to polar, cylindrical, and spherical coordinates, practical applications.
3. Line integrals : definition, orientation, calculation over parameterized curves in various geometric contexts.
4. Applications in physics and engineering : volume, center of mass, moment of inertia, work of a force, flux of fields calculations.
5. Fundamental theorems : Green–Riemann theorem and introduction to Stokes and Gauss for solving concrete problems.

BIBLIOGRAPHY

REQUIREMENTS

- Differentiation and integration of single-variable functions
- Multivariable functions and partial derivatives

— Vector calculus
— Calculation of the determinant of a 3×3 matrix