

School of Industrial Engineering and Telecommunications

# SUBJECT TEACHING GUIDE

### G281 - Calculus I

## Degree in Telecommunication Technologies Engineering First Degree in Telecommunication Technologies Engineering

Academic year 2023-2024

| 1. IDENTIFYING DATA              |  |                  |     |               |                              |              |  |  |  |  |
|----------------------------------|--|------------------|-----|---------------|------------------------------|--------------|--|--|--|--|
| Degree                           | Degree in Telecommunication Technologies Engineering<br>First Degree in Telecommunication Technologies Engineering |                  |     | Type and Year | Core. Year 1<br>Core. Year 1 |              |  |  |  |  |
| Faculty                          | School of Industrial Engineering and Telecommunications  |                  |     |               |                              |              |  |  |  |  |
| Discipline                       | Subject Area: Mathematics<br>Basic Training Module   |                  |     |               |                              |              |  |  |  |  |
| Course unit title<br>and code    | G281 - Calculus I  |                  |     |               |                              |              |  |  |  |  |
| Number of ECTS credits allocated | 6  | Term Sen         |     | Semeste       | Semester based (1)           |              |  |  |  |  |
| Web                              |  |                  |     |               |                              |              |  |  |  |  |
| Language of instruction          | Spanish  | English Friendly | Yes | Mode of a     | delivery                     | Face-to-face |  |  |  |  |

| Department       | DPTO. MATEMATICA APLICADA Y CIENCIAS DE LA COMPUTACION                                 |  |  |
|------------------|--|--|--|
| Name of lecturer | MARCO BRAVIN   |  |  |
|                  |  |  |  |
| E-mail           | marco.bravin@unican.es   |  |  |
| Office           | E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 5. DESPACHO (S5019) |  |  |
| Other lecturers  | ANA CASANUEVA VICENTE  |  |  |
|                  | VERA EGOROVA   |  |  |

### **3.1 LEARNING OUTCOMES**

- To solve mathematical problems in engineering. To apply methods of differential calculus of one or more variables, as well as integral methods of one variable, to solve telecommunication engineering problems. Use numerical methods to approximate results.



#### School of Industrial Engineering and Telecommunications

#### 4. OBJECTIVES

To understand and have good command of the most important concepts and tools in differential calculus of one and two variables, as well as integral calculus of one variable.

To acquire skills in the use of mathematical software as an aid in the resolution of problems

| 6. COURSE ORGANIZATION |   |  |  |  |  |  |
|------------------------|---|--|--|--|--|--|
|                        | CONTENTS  |  |  |  |  |  |
| 1                      | BLOCK 1   |  |  |  |  |  |
| 1.1                    | Lesson 1: Complex Numbers.<br>1.1 Definition. Graphical representation in the Gauss plane. Ways of defining a complex number.<br>1.2 Basic operations. Powers and radicals.   |  |  |  |  |  |
| 1.2                    | <ul> <li>Lesson 2: Real one-variable functions.</li> <li>2.1 Definition. Domain and image. Graphics of basic functions. Properties. Continuity.</li> <li>2.2 Derivative in one point: definition and geometric interpretation. Derivatives calculation.</li> <li>2.3 Taylor and Maclaurin polinomials. Taylor's Theorem. Applications. Extremes calculation. Equivalent functions.</li> </ul>   |  |  |  |  |  |
| 1.3                    | Lesson 3: Numerical series. Power series.<br>3.1 Definition. Growth and bounds. Convergence. Equivalent series.<br>3.2 Series of real numbers. Alternating series. Absolute convergence.<br>3.3 Power series. Definition. Convergence of a power series Theorem.  |  |  |  |  |  |
| 2                      | BLOCK 2   |  |  |  |  |  |
| 2.1                    | <ul> <li>Lesson 4: Integral calculus of one-variable functions.</li> <li>4.1 Primitive. Integration methods.</li> <li>4.2 Riemann's integral. Integral functions. Mean value Theorem. Fundamental Theorem of integral calculus. Barrow's rule.</li> <li>4.3 Applications of the definite integral.</li> </ul>   |  |  |  |  |  |
| 2.2                    | <ul> <li>Lesson 5: Differential calculus of two-variable functions.</li> <li>5.1 Definition. Domain and image. Level curves and graphics.</li> <li>5.2 Directional derivative: definition and geometric interpretation. Partial derivatives: definition, geometric interpretation and calculation. Partial derivatives of n order. Tangent plane and linear approximation. Gradient. The chain rule. Implicit functions.</li> <li>5.3 Extremes. Maxima, minima and tipping points. Relative extremes of differential functions. Conditioned extremes.</li> <li>Lagrange multipliers.</li> </ul> |  |  |  |  |  |



#### School of Industrial Engineering and Telecommunications

| 7. ASSESSMENT METHODS AND CRITERIA               |  |             |           |       |  |  |  |  |
|--|--|-------------|-----------|-------|--|--|--|--|
| Description                                      | Туре                                   | Final Eval. | Reassessn | %     |  |  |  |  |
| Laboratory (computer) practices                  | Laboratory evaluation                  | No          | Yes       | 25,00 |  |  |  |  |
| Tests  | Activity evaluation with Virtual Media | No          | No        | 10,00 |  |  |  |  |
| Theoretical and practical examination of block 1 | Written exam                           | No          | Yes       | 32,50 |  |  |  |  |
| Theoretical and practical examination of block 2 | Written exam                           | Yes         | Yes       | 32,50 |  |  |  |  |
| TOTAL  |  |             |           |       |  |  |  |  |

Observations

A student can go to the extraordinary examination only to those recoverable parts that he /she failed (score of less than 5 out of 10 points).

The final score will be 4.9 (fail) for those students who, while having a mean score of above 5, got less than the minimum score in any of the evaluated activities.

Unjustified answers, inaccurate use of mathematical terminology and concepts and the lack of basic mathematical competences will be penalized.

Observations for part-time students

The subject can be entirely followed through the Moodle website. Those students enrolled part-time, who request it at the beginning of the term, may have a single evaluation, which means having all the theoretical and practical exams of all the subject blocks and the computer practices in the ordinary examination.

#### 8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Bradley, G. L. And Smith, K. Calculo de una variable y Cálculo de varias variables. Volumen I y II. Prentice Hall. ISBN: 84-89660-76-X.

http://catalogo.unican.es.unican.idm.oclc.org/cgi-bin/abnetopac/?TITN=145826

Smith, R. y Minton, R.B. Cálculo. Volumen 1 y 2. Editorial Mc Graw-Hill. ISBN: 84-481-3861-9. http://catalogo.unican.es.unican.idm.oclc.org/cgi-bin/abnetopac/?TITN=211158

Steward, J. Cálculo: conceptos y contextos. 3º Edición. Thomson Learning. ISBN: 0-534-40986-5.

http://catalogo.unican.es.unican.idm.oclc.org/cgi-bin/abnetopac/?TITN=331269

http://catalogo.unican.es.unican.idm.oclc.org/cgi-bin/abnetopac/?TITN=332794

Larson, R. y Edwards. B.H. Calculo 1 de una variable. Editorial Mc Graw-Hill. ISBN: 978-607-15-0273-5.

Calculo 2 de varias variables. Editorial Mc Graw-Hill. ISBN: 978-970-19-7134-2

http://catalogo.unican.es.unican.idm.oclc.org/cgi-bin/abnetopac/?TITN=324671