

Academic Year: ( 2022 / 2023 )

Review date: 07-07-2022

Department assigned to the subject: Mathematics Department

Coordinating teacher: LLEDO MACAU, FERNANDO

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 1

Branch of knowledge: Engineering and Architecture

## OBJECTIVES

By the end of this content area, students will be able to have:

1. Knowledge and understanding of the mathematical principles underlying their branch of engineering.
2. The ability to apply their knowledge and understanding to identify, formulate and solve mathematical problems using established methods.
3. The ability to select and use appropriate tools and methods to solve mathematical problems.
4. The ability to combine theory and practice to solve mathematical problems.
5. The ability to understanding of mathematical methods and procedures, their area of application and their limitations.

## DESCRIPTION OF CONTENTS: PROGRAMME

### Part I: Real Numbers and Functions

#### Chapter 1: The Real Line

- 1.1 Ordered Fields
- 1.2 Number Systems
- 1.3 Absolute value, bounds, and intervals

#### Chapter 4: Real Functions

- 2.1 Definition and basic concepts
- 2.2 Elementary functions
- 2.3 Operations with functions

### Part II: Sequences and Series

#### Chapter 3: Sequences

- 3.1 Sequences of real numbers
- 3.2 Limit of a sequence
- 3.3 Number  $e$
- 3.4 Indeterminacies
- 3.5 Asymptotic comparison of sequences

#### Chapter 4: Series

- 4.1 Series of real numbers
- 4.2 Series of nonnegative terms
- 4.3 Alternating series
- 4.4 Telescopic series

### Part III: Differential Calculus

#### Chapter 5: Limit of a Function

- 5.1 Concept and definition
- 5.2 Algebraic properties
- 5.3 Asymptotic comparison of functions

#### Chapter 6: Continuity

- 6.1 Definition, properties, and continuity of elementary functions
- 6.2 Discontinuities
- 6.3 Continuous functions in closed intervals

## Chapter 7: Derivatives

### 7.1 Concept and definition

### 7.2 Algebraic properties

### 7.3 Derivatives and local behaviour

## Chapter 8: Taylor expansions

### 8.1 Asymptotic comparison of functions

### 8.2 Taylor's polynomial

### 8.3 Calculating limits

### 8.4 Remainder and Taylor's theorem

### 8.5 Taylor series

### 8.6 Numerical approximations

### 8.7 Local behaviour of functions

### 8.8 Function graphing

## Part IV: Integral Calculus

## Chapter 9: Primitives

### 9.1 Integration by parts

### 9.2 Primitives of rational functions

### 9.3 Change of variable

## Chapter 10: Fundamental Theorem of Calculus

### 10.1 Riemann's integral

### 10.2 Properties of the integral

### 10.3 Riemann's sums

### 10.4 Fundamental theorem of calculus

## Chapter 11: Geometric Applications of Integrals

### 11.1 Area of flat figures

### 11.2 Area of flat figures in polar coordinates

### 11.3 Volumes

### 11.4 Length of curves

## Chapter 12: Improper Integrals

### 12.1 Improper integrals of the first kind

### 12.2 Improper integrals of the second kind

## LEARNING ACTIVITIES AND METHODOLOGY

The methodology will be the usual one for classes in the classroom, writing on the blackboard, with the occasional help of some resources on-line to illustrate some graphic or computational aspects of the course. Also, the classroom notes will be uploaded in Aula Global at the end of each chapter, along with the problem sheets that will be solved and discussed in the small groups.

## ASSESSMENT SYSTEM

The final grade will be assigned through the students' performance in two kinds of tests: (a) partial tests along the term, with a weight of 40% in the final grade, and (b) a final exam, amounting to 60% of the final grade.

The weights above, as well as the marks obtained in the midterm tests, will be kept for those students who have to take the extraordinary exam---provided it is beneficial for the student's final grade.

<b>% end-of-term-examination:</b>	60
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	40

## BASIC BIBLIOGRAPHY

- Adrian Banner The Calculus Lifesaver: All the tools you need to excel at calculus, Princeton University Press, 2007
- H. Anton, I.C. Bevis & S. Davis Calculus: Early Transcendentals Single Variable, Wiley, 2008
- J. Stewart Single variable calculus: early transcendentals, Brooks-Cole, 1999
- R. Larson, R.P. Hostetler & B.H. Edwards Calculus, Brooks-Cole, 2005
- S.L. Salas, G.J. Etgen & E. Hille Calculus: One and Several Variables, Wiley, 2006

#### ADDITIONAL BIBLIOGRAPHY

- T.M. Apostol Calculus vol. 1, Wiley, 1991

#### BASIC ELECTRONIC RESOURCES

- Gilbert Strang & Edwin Herman . Calculus: <a href="https://math.libretexts.org/Bookshelves/Calculus/Book%3A\_Calculus\_(OpenStax)" target="\_blank">https://math.libretexts.org/Bookshelves/Calculus/Book%3A\_Calculus\_(OpenStax)</a>