SAGRADO
Universidad del Sagrado Corazón

SCHOOL OF HEALTH AND SCIENCES

SYLLABUS

TITLE:	Calculus I
CODE:	MAT 201
PREREQUISITE	MAT 134
CREDITS:	5 credits | 75 contact hours | 1 term

DESCRIPTION

This is a theoretical and practical course that develops analytical skills in the student at the School of Health and Sciences. The course deals with differential calculus and basic integration into a variable. In this course the following concepts are studied: limits, derivatives and their applications, indefinite and definite integration, fundamental theorem of calculus and introduction to differential equations. The purpose of the course is to establish the tools of differential and integral calculus necessary for the advanced study of natural sciences.

JUSTIFICATION

The skills developed in this course are essential for continuing higher studies in the different fields of mathematics and natural sciences. This is because quantitative modeling is an integral part of these disciplines. Calculus, in turn, is the knowledge that originates the foundations that nourish the development of mathematical models.

COMPETENCES

The course develops the following competences in students:

- **Critical questioning**
- **Research and exploration**

OBJECTIVES

After completion of the course, students will be able to:

1. Intuitively define the concept of limit and continuity.
2. Define the derivative of a function.
3. Derive rational, irrational, exponential trigonometric, and logarithmic polynomial functions.
4. Plot graphs of arbitrary functions.
5. Solve optimization and related exchange rate problems.
6. Identify anti-derivatives.
7. Define the integral of a function.
8. Integrate polynomial, rational, irrational, trigonometric, exponential, and logarithmic functions.
9. Demonstrate the fundamental theorem of Calculus.
10. Calculate areas under curves and between curves.
11. Solve first-order differential equations by means of variable separation or the integration factor.

CONTENTS

I. Limit of a Function
   A. The intuitive concept at the limit of a function
   B. Algebraic techniques for finding limits
   C. Lateral limits
   D. Continuous functions

II. The Derivative
   A. Average rate of change
   B. Instantaneous rate of change
   C. Geometric interpretation of the derivative
   D. Formulas for finding derivatives
   E. Derivative from a composite function
      1. Chain rule
      2. Power rule
   F. Implicit differentiation
   G. Higher order derivatives
   H. Derivatives of the inverse function

I. Derivatives of trigonometric functions
J. Derivatives of logarithmic and exponential functions

III. Applications of the Derivative
A. Rate of change
B. Differentials
C. Maximums and minimums
D. Rolle's theorem
E. Mean-value theorem
F. Increasing and decreasing functions
G. Concavity
H. Limits at infinity
I. Infinite limits
J. Asymptotes
1. Vertical
2. Horizontal
3. Obliques
K. Extreme point application theorems
L. Newton's method
M. Antiderivative
N. Differential equations
1. Separation of variables
2. Integration factor

IV. The Integral
A. Areas
B. Evaluation of Areas
C. Sigma notation
D. Definite integral
E. Riemann sums
F. The fundamental theorem of calculus
G. Properties of the definite integral
H. Integration by substitution
I. Substitution method
J. Applications of the definite integral

K. Areas between curves
L. Applications of integrals to areas under curve
M. Numerical integration
    1. Trapezoid rule
    2. Simpson rule

METHODOLOGY

The following strategies from the active learning methodology are recommended:

- Flipped classroom
- Problem discussion
- Collaborative learning
- Teamwork
- Procedure and problem-solving oriented coaching
- Demonstration and practical exercises
- Self-assessment and peer assessment
- Application of theorems and formulas
- Problem based learning

EVALUATION

Participation	10%
Compositions	20%
Partial assignments	40%
Final project or exam	30%
Total	**100%**

LEARNING ASSESSMENT

The institutional assessment rubric is applied to the course's core activity.

BIBLIOGRAPHY

TEXTBOOK

Larson R., Edwards, B.H. (2018). *Calculus* (11th ed.). Cengage Learning.

REFERENCES

Larson, R., Falvo, D.C. (2016). *Precalculus with limits* (4th ed.). Cengage Learning.

Martínez Gómez, E. D. J., Tejada Betancourt, L. (Il.). (2018). *Cálculo y geometría analítica*. Universidad Abierta para Adultos (UAPA). https://elibro.net/es/lc/sagrado/titulos/175889

Miller, J., Gerken, D. (2017). *Precalculus*. McGraw-Hill Education.

Stewart J. (2016). *Calculus: Early Transcendentals* (8th ed.). Cengage Learning.

Swokowski, E. (2019). *Precalculus: Functions & Graphs* (13th ed.). Addison Wesley

ELECTRONIC RESOURCES

Math Differential Calculus: https://www.khanacademy.org/math/calculus

Symbolab: https://www.symbolab.com/

Wolframalpha Computational Intelligence: https://www.wolframalpha.com/

For more information resources related to the course's topics, access the library's webpage http://biblioteca.sagrado.edu/

REASONABLE ACCOMMODATION

For detailed information on the process and required documentation you should visit the corresponding office. To ensure equal conditions, in compliance with the ADA Act (1990) and the Rehabilitation Act (1973), as amended, any student in need of reasonable accommodation or special assistance must complete the process established by the Vice Presidency for Student Affairs.

- Students participating in the Student Support Program (PAE, in Spanish) shall request their reasonable accommodation in PAE's offices.
- Students who do not participate in PAE shall request their reasonable accommodation at the Integral Wellness Center (*Centro de Bienestar Integral*, in Spanish).

ACADEMIC INTEGRITY

This policy applies to all students enrolled at Universidad del Sagrado Corazón to take courses with or without academic credit. A lack of academic integrity is any act or omission that does not demonstrate the honesty, transparency, and responsibility that should characterize all academic activity. Any student who fails to comply with the

Honesty, Fraud, and Plagiarism Policy is exposed to the following sanctions: receive a grade of zero in the evaluation and / or repetition of the assignment in the seminar, a grade of F (*) in the seminar, suspension, or expulsion as established in the Academic Integrity Policy effective in November 2022.

RESEARCH COURSES

This course may require students to practice tasks related to the research process, such as taking informed consent or assent, administering instruments, conducting interviews, observations, or focus groups, among others. These assignments are part of an academic exercise and the information collected will not be used to share with third parties or disclose it in settings other than the classroom with the professor teaching the course. Every student, as well as their professor, who will interact with human subjects as part of their research practice must be certified in ethics with human subjects in research by the Collaborative Institutional Training Initiative (CITI Program).

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