SAGRADO
Universidad del Sagrado Corazón

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 of the School of Natural Sciences. The course deals with differential calculus and basic integration in one variable. It covers the following concepts: 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 provide the tools of differential and integral calculus necessary for the advanced study of the natural sciences.

JUSTIFICATION

The skills developed in the course of this course are indispensable for further studies in the various fields of mathematics and the natural sciences. This is because quantitative modeling is an integral part of these disciplines. Calculus, in turn, is the knowledge that gives rise to the foundations that nourish the development of mathematical models.

COMPETENCES

The course develops in the student the following competencies:

- **Critical Thinking**
- **Research and exploration**

OBJECTIVES

At the end of the course, students will be trained to:

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

CONTENT

I. Limit of a function

   A. Intuitive concept to the limit of a function
   B. Algebraic techniques to find limits
   C. Lateral limits
   D. Continuity of functions

II. The derivative

   A. Average rate of change
   B. Ratio of instantaneous change
   C. Geometric interpretation of the derivative
   D. Formulas for finding derivatives
   E. Derivative of a composite function
      1. chain rule
      2. power rule
   F. Implicit differentiation

G. Higher order derivatives
H. Inverse function derivatives
I. Derivatives of trigonometric function
J. Derivatives of logarithmic and exponential functions

III. Applications of the derivative

A. Related rates 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. oblique
K. Extreme point application theorems
L. Newton's method
M. Antiderivatives
N. Differential equations
    1. Separation of variables
    2. Integration factor

IV. The Integral

A. Areas
B. Evaluation of areas
C. Sigma notation
D. The definite integral
E. Riemann sums
F. The fundamental theorem of Calculus
G. Properties of the definite integral
H. The substitution integral
I. Substitution method
J. Applications of the definite integral
K. Areas between curves
L. Applications of integrals to areas under curves

M. Numerical Integration
    1. Trapezoid rule
    2. Simpson's rule

METHODOLOGY

The following strategies of the active learning methodology are recommended:

- Flipped classroom
- Problem discussion
- Collaborative learning
- Teamwork
- Procedure-oriented coaching and problem solving.
- Demonstration and hands-on exercises
- Self-assessment and peer evaluation
- Application of theorems and formulas
- Problem-based learning
- Graphs and functions

EVALUATION

Participation	10%
Compositions	30%
Partial Assignment	30%
Project or final exam	30%
Total	100%

LEARNING ASSESSMENT

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

BIBLIOGRAPHY

TEXT

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

REFERENCES

Larson R., Falvo D.C. (2016) *Precalculus with Limits*. (4th edition) Boston: Cengage Learning.

Miller J., Gerken D. (2017) Precalculus. (1st edition) New York: McGraw-Hill Education.

Stewart J. (2016) *Calculus: early tracendentals.* (8th edition). Boston: Cengage Learning.

Swokowski E. (2019) *Precalculus: Functions & Graph*s. (13th edition) New York: Addison Wesley.

ELECTRONIC RESOURCES

https://www.khanacademy.org/math/calculus

https://www.symbolab.com/

https://www.wolframalpha.com/

Find more information resources related to the course topics on the library page http://biblioteca.sagrado.edu/

REASONABLE ACCOMMODATION

To obtain detailed information on the process and the required documentation, you must visit the corresponding office. To guarantee equal conditions, in compliance with the ADA (1990) and the Rehabilitation Act (1973), as amended, all students who need reasonable accommodation services or special assistance must complete the process established by the Vice Presidency for Academic Affairs.

ACADEMIC HONESTY, FRAUD AND PLAGIARISM

Any student who misses the policy of honesty, fraud and plagiarism is exposed to the following sanctions: received a grade of zero in the evaluation and / or repetition of the work in the course, grade of F (*) in the seminar: suspension or expulsion as established in the Academic Honesty Policy document (DAEE 205-001) effective August 2005.