## A) COURSE

| Course Id: | Course |
|---|---|
| 0051 | Calculus A |

| Class Hours per Week | Lab hours per week | Complementary practices | Credits | Total hour course |
|---|---|---|---|---|
| 3 | 2 | 3 | 8 | 80 |

## B) GENERAL COURSE INFORMATION:

| | EE (IEA) | ME (IM) | MME (IMA) | EME (IME) | MTE (IMT) |
|---|---|---|---|---|---|
| **Level:** | I | I | I | I | I |
| **Course Type (Required/Elective)** | Required | Required | Required | Required | Required |
| **Prerequisite Course:** | | | | | |
| **CACEI Classification:** | BS | BS | BS | BS | BS |

## C) COURSE OBJECTIVE

| At the end of the course, the student will be capable of: |
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| Understanding and solving the problems of his environment by means of the topics analyzed and will realize that it will be a useful tool for the continued study of calculating several variables and moreover in professional development.<br>1. To learn the basic concepts of calculus.<br>2. To apply those concepts toward solving of problems.<br>3. To interpret those solutions.<br>4. To relate the exercises carried out with those arising during his engineering formation. |

## D) TOPICS (CONTENTS AND METHODOLOGY)

| 1. Real numerical straight line. | **12 hours** |
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| Specific Objective: | The student will become familiar, handle and apply the relative principles and theorems to the real numerical straight line toward solving the given problems under the unequal form, as well as the geometric representation of the solution in the same. |

1.- Real numbers.
1.1.- Forms of the set.
1.2.- Relationship of order.
2.- Definition.
2.1.- Properties.
3.- Inequations.
3.1.- Definition and classification.
3.2.- Solving inequations: a) first degree, one incognite, numerical and whole b) second degree, one incognite, numerical and whole c) fractions in an incognite.
4.- Absolute value.
4.1.- Definition and interpretation.
4.2.- Inequations in absolute value.

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| **Readings and other resources** | Books, Articles. |
| **Teaching Methodologies** | Presentation in class, guided instruction, student interaction. |
| **Learning Activities** | Assignments and discussion of these, collection practices and data analysis. |

| 2. - Analysis of analytical geometry concepts, formulas and graphs. | | **12 hours** |
|---|---|---|
| Specific Objective: | The student will become familiar with the origin of the cartesian plane, build relations, its mathematical, geometrical and functional interpretation; will acquire skill and understanding regarding the cartesian plane of other relations, its geometrical representation and how to calculate its domain and range based on inequalities. | |
| 1.- Cartesian plane.<br>1.1.- Origin and geometric representation.<br>1.2.- Mathematical relation definition.<br>1.3.- Relations in finite and infinite sets. Infinites: straight lines, parabolas, circumference 1.4.- mathematical and geometric representation.<br>2. - Functions.<br>2.1.- Definition and parts, domain, codomain, range.<br>2.2.- Classification according to the representing expression<br>a) explicit algebraic: constant, identical, power, rational polynomial, irrational<br>b) trigonometric: sine, cosine, tangent, cotangent,<br>c) amplitude secant, period and its variations, geometry of trigonometry functions. | | |
| **Readings and other resources** | Books, Articles. | |
| **Teaching Methodologies** | Presentation in class, guided instruction, student interaction. | |
| **Learning Activities** | Assignments and discussion of these, collection practices and data analysis. | |

| 3. Limits and their properties. | | **14 hours** |
|---|---|---|
| Specific Objective: | The student will become familiar with the need for the limit, which he will define and apply in the geometric analysis of a function, as well as learning and handling of the theorems regarding limits; he will learn some special limits and their application in solving others. | |
| 3.- Introduction to the limit concept (geometric and analytical) of a function.<br>3.1.- Theorems regarding function limits.<br>3.2- Unilateral limits in algebra functions, complex and special.<br>3.3.- Techniques for calculating limits.<br>3.4.- Limits to the infinite related with vertical and horizontal asymptotes.<br>3.5.- Continuity and theorems regarding continuity (in a number and in an interval).<br>3.6.- Discontinuity. | | |
| **Readings and other resources** | Books, Articles. | |
| **Teaching Methodologies** | Presentation in class, guided instruction, student interaction. | |
| **Learning Activities** | Assignments and discussion of these, collection practices and data analysis. | |

| 4. The derivative. | | **14 hours** |
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| Specific Objective: | The student will become familiar, interpret, calculate and apply the derivative as a special limit, its existence, the rules for obtaining it, explicit as well as implicitly. It practical application as a reason of change within: geometry, physics, etc. The student will understand and calculate the derivatives of superior order, learn the concept of the inverse function and the conditions for their existence, learn its geometry and the way to obtain its derivative. The student will learn, geometrize, and derive the trigonometry, logarithmic, hyperbolic functions and their inverses | |

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| 4.- Algebra functions.<br>4.1.- Definition, notation and geometric interpretation of the derivative, cases of non existence, derivative of a function: at a point, at an interval.<br>4.2.- Deriving by increments.<br>4.3.- Velocity, acceleration and other reasons of change. Give examples that may implicit the concept.<br>4.4.- Rules of derivation for: additions, products, quotients, and powers.<br>4.5.- Rule of chain and function to a power.<br>4.6.- Alternate form of the derivative.<br>4.7.- Implicit derivation.<br>4.8.- Related reasons (problems) b) trigonometry functions.<br>4.9.- Rules of derivation for: sine, cosine, tangent, cotangent, secant and cosecant c) logarithmic functions.<br>4.10.- Rules of derivation d) inverse functions.<br>4.11.- Exponential functions and derivation.<br>4.12.- Trigonometry inverse functions and derivation e) deriving hyperbolic functions.<br>4.13.- Rules of derivation. | |
| **Readings and other resources** | Books, Articles. |
| **Teaching Methodologies** | Presentation in class, guided instruction, student interaction. |
| **Learning Activities** | Assignments and discussion of these, collection practices and data analysis. |

| 5. Applications of the derivative. | **14 hours** |
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| Specific Objective: | The student will apply the acquired knowledge to the geometric analysis of a function (max, min, p.i. etc.) As well as its application regarding practical problems in his surroundings. |
| 5.1.- The derivative as a reason for a change.<br>5.2- Tangent and normal straight line of a curve.<br>5.3.- Applications to physics (velocity, acceleration, free fall).<br>5.4.- Application to chemistry.<br>5.5.- Application to engineering.<br>5.6.- Variation regarding time (chain rule).<br>5.7.- Extreme values of a function.<br>5.8.- Increase and decrease.<br>5.9.- Maximums and minimums (absolute and relative).<br>5.10.- Concavity and reflecting point, criteria of the second derivative inflexion.<br>5.11.- Rolle theorem and theorem of mid value.<br>5.12.- Application of maximums and minimums.<br>5.13.- Rule of H´opital. | |
| **Readings and other resources** | Books, Articles. |
| **Teaching Methodologies** | Presentation in class, guided instruction, student interaction. |
| **Learning Activities** | Assignments and discussion of these, collection practices and data analysis. |

| 6. Integration. | **14 hours** |
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| Specific Objective: | The student will understand, become familiar, calculate and apply the differential of a function or concept of integration, acquire algebra skills in the calculation or solution of an integral. |
| 6.1.- The inverse of differentiation.<br>6.2.- Anti-differential and applications.<br>6.3.- Fundamental formulas of integration.<br>6.4.- Methods of integration: a) in parts b) trigonometry substitutions c) partial fractions.<br>6.5.- Different variable changes a) algebra b) trigonometry.<br>6.6.- Defined integration: a) properties b) mid value theorem for integrals c) fundamental theorem of calculus d) area of a region between two curves. | |
| **Readings and other resources** | Books, Articles. |
| **Teaching Methodologies** | Presentation in class, guided instruction, student interaction. |

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|---|---|
| **Learning Activities** | Assignments and discussion of these, collection practices and data analysis. |

**E) TEACHING AND LEARNING METHODOLOGIES**

1. Conventional exposure of each subject by the teacher.
2. Problem-based learning.

**F) EVALUATION CRITERIA:**

| Evaluation: | Schedule | Suggested Form of Evaluation and weighing | Topics |
|---|---|---|---|
| 1st. Partial Evaluation | 16 sessions | Exam 80%, Tasks 20%; | 1 y 2 |
| 2nd Partial Evaluation | 16 sessions | Exam 80%, Tasks 20%; | 3 y 4 |
| 3rd. Partial Evaluation | 16 sessions | Exam 80%, Tasks 20%; | 4 y 5 |
| 4th Partial Evaluation | 16 sessions | Exam 80%, Tasks 20%; | 6 |
| Final Ordinary Evaluation | | 100% (Average of the Partial Evaluations) | |
| Other activities: | | | |
| Extraordinary Exam | Week 17 of the semester in course | Exam 100% | Topics 100% |
| Title Exam | According to the program of the School Secretary. | Exam 100% | Topics 100% |
| Regularization Exam | According to the schedule of the School Secretary | Exam 100% | Topics 100% |

**G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES**

**Main Books**

1. Cálculo, Stewart James. Thomson Learning. Cuarta edición México 2002 “A”.
2. Cálculo Larson/Hostetler/Edwards, Quinta Edición México 1995 “B”.
3. Cálculo con Geometría analítica Warl W. Smokowski II Edición “B”
4. Cálculo Diferencial e Integral. Frank Agres Jv. Elliot Mendelson Mc Graw Hill “A”

**Complementary Books**

**Internet Links**