University of Engineering and Technology
School of Computer Science
Syllabus of Course
Academic Period 2018-II

1. **Code and Name:** EG0003. Mathematics I
2. **Credits:** 4
3. **Hours of theory and Lab:** 4 HT;
4. **Professor(s)**

   Meetings after coordination with the professor
5. **Bibliography**

[Lar14] Ron Larson. *Calculus*. 10th. CENGAGE Learning, 2014.

[Ste12] James Stewart. *Calculus*. 7th. CENGAGE Learning, 2012.

6. **Information about the course**

   (a) **Brief description about the course** The course aims to develop in students the skills to deal with models in science and engineering related to single variable differential calculus skills. In the course it is studied and applied concepts related to calculation limits, derivatives and integrals of real and vector functions of single real variables to be used as base and support for the study of new contents and subjects. Also seeks to achieve reasoning capabilities and applicability to interact with real-world problems by providing a mathematical basis for further professional development activities.

   (b) **Prerrequisites:** None

   (c) **Type of Course:** Mandatory

   (d) **Modality:** Face to face

7. **Specific goals of the Course**

   - Apply the concepts of complex numbers and functions to solve problems related to science.
   - Apply mathematical concepts and techniques of differential calculus of one variable to solve problematic situations of science.
   - Calculate mathematical expressions of indefinite integrals with accuracy, order and clarity in the treatment of the data.

8. **Contribution to Outcomes**

   a) An ability to apply knowledge of mathematics, science. (**Assessment**)

   j) Apply the mathematical basis, principles of algorithms and the theory of Computer Science in the modeling and design of computational systems in such a way as to demonstrate understanding of the equilibrium points involved in the chosen option. (**Assessment**)

9. **Competences (IEEE)**

   C1. An intellectual understanding and the ability to apply mathematical foundations and computer science theory.⇒ **Outcome a**

   C20. Ability to connect theory and skills learned in academia to real-world occurrences explaining their relevance and utility.⇒ **Outcome j**

C24. Understanding the need for lifelong learning and improving skills and abilities.⇒ **Outcome j**

10. List of topics

1. Complex numbers
2. Functions of a single variable
3. Limits and derivatives
4. Integrals

11. Methodology and Evaluation
Methodology:

Theory Sessions:
The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

Lab Sessions:
In order to verify their competences, several activities including active learning and roleplay will be developed during lab sessions.

Oral Presentations:
Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

Reading:
Throughout the course different readings are provided, which are evaluated. The average of the notes in the readings is considered as the mark of a qualified practice. The use of the UTEC Online virtual campus allows each student to access the course information, and interact outside the classroom with the teacher and with the other students.
Evaluation System:

12. Content

<table>
<tr><td colspan="2">Unit 1: Complex numbers (20)</td></tr>
<tr><td colspan="2">Competences Expected: C1</td></tr>
<tr><td>Learning Outcomes</td><td>Topics</td></tr>
<tr><td>• Define and operates with complex numbers, calculating their the polar and exponential form [Assessment].
• Use Moivre's theorem to simplify calculations of complex [Assessment].</td><td>• Operations with complex numbers
• Moivre's theorem</td></tr>
<tr><td colspan="2">Readings : [Ste12], [Lar14]</td></tr>
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Unit 2: Functions of a single variable (10)	
Competences Expected: C20	
Learning Outcomes	**Topics**
• Define a function of single variable and understand and be able to determine its domain and range. [Assessment]. • Recognize different specific types of functions and create scatter plots and select an appropriate model. [Assessment]. • Understand how a change in base affects the graph of exponentials and logarithmic functions. [Assessment]. • Recognizes and builds trigonometric functions.[Assessment]. • Apply rules to transform functions[Assessment]. • Be able to solve simple applications problems such as regression and curve fitting. [Assessment].	• Domain and range. • Types of functions. • Graph of exponentials and logarithmic functions. • Trigonometric functions. • Apply rules to transform functions. • Applications problems using Excel,modelling bacterial growing, Logarithmic scale, etc.
Readings : [Ste12], [Lar14]	

Unit 3: Limits and derivatives (20)	
Competences Expected: C1	
Learning Outcomes	**Topics**
• Understand the concept of limits and guess limits from the graph of a function. [Assessment]. • Find limits using the limit laws and algebraic simplification. [Assessment]. • Find vertical and horizontal asymptotes. [Assessment]. • Compute and estimate derivatives. [Assessment]. • Interpret the derivative as a rate of change. [Assessment]. • Find the derivatives of basic and composed function[Assessment]. • Approximates functions using derivate concepts and compute relative errors. [Assessment]. • Find critical numbers, and absolute and local maximum and minimum values for continuous function. [Assessment]. • Apply L'Hospital theorem to calculate some limits. [Assessment]. • Understand optimization problems, find the function to be optimized and solve.[Assessment]. • Be able to solve simple applications problems. [Assessment].	• Limits • Derivatives • Derivate concepts and compute relative errors. • L'Hospital theorem • Applications problems such as velocity, exponential growth and decay, pile increasing gravel, optimization of a can, etc
Readings : [Ste12], [Lar14]	

Unit 4: Integrals (22)	
Competences Expected: C20	
Learning Outcomes	**Topics**
• Solve properly estimate area using left and right endpoint and midpoint rectangles. [Assessment]. • Use the Fundamental theorem to find derivatives of functions of evaluate definite and indefinite integrals using substitution. [Assessment]. • Use different technic to integrate functions. [Assessment]. • Apply integrals to found areas. [Assessment]. • Compute volumes of solids obtained by rotating a bounded region about either the x-axis or the y-axis. [Assessment]. • Compute the volume of solids obtained by rotating a bounded region about either the x-axis or the y-axis by considering cylindrical shells. [Assessment]. • Compute the average value of a function. [Assessment]. • Compute work done by a force and compute center of mass for a flat plate in the plane. [Assessment]. • Define parametric curves and vectorials functions finding relationships between them. [Assessment]. • Apply integrals to calculate the length of curves described by a vectorial functions[Assessment]. • Be able to solve simple applications problems such as traffic on an Internet service, fuel consumption, tomography: volume of the brain, pump the water, mass in thickener, superformula, volume in Wankel machine, length of DNA molecule helix, etc. [Assessment].	• Strategy for integration. • Technic to integrate functions. • Additional Tools to Find Integrals. • Applications problems.
Readings : [Ste12], [Lar14]	