Analysis 1

1. **Course number and name**: 020AA1NI2/020AY1NI2 Analysis 1

2. **Credits and contact hours**: 4 ECTS credits, 2x1:15 contact hours

3. **Name of course coordinator:** Georges Chamoun

4. **Instructional Materials:**
   - Lecture notes and slides provided by the instructor
   - Practice problem sets and worksheets
   - Past exams and solutions
   - Solutions manual containing step-by-step solutions to the problem sets
   - Additional references: Thomas Jr., G.B., Weir, M.D. and Hass, J. (2013) Thomas' Calculus, edition 12, Pearson, Boston, New York

5. **Specific course information**
   a. **Catalog description:**
   The course "Analysis 1" aims to develop a deep understanding of fundamental concepts in mathematical analysis and equip students with the ability to apply these tools to solve more advanced mathematical problems. It covers topics such as Taylor series expansions for approximating functions and studying their local behavior around a point. Students also learn about anti-derivatives and improper integrals, gaining the skills to manipulate them effectively. Additionally, the course delves into the convergence or divergence of numerical series, teaching students how to determine convergence using specific criteria. Overall, these learnings prepare students to tackle complex mathematical problem-solving tasks.

   b. **Prerequisites**: None

   c. **Required/ Selected Elective/Open Elective:** Required

6. **Educational objectives for the course**

   a. **Specific outcomes of instruction:**
      - Demonstrate a thorough understanding of function approximation and the analysis of local behavior.
      - Apply Taylor and Maclaurin series expansions effectively to approximate functions in the neighborhood of any given point.
      - Utilize finite Taylor expansions to compute limits, to determine tangent lines, and to identify asymptotes.
      - Manipulate antiderivatives of functions using integration techniques such as integration by parts and substitutions methods.
      - Evaluate definite integrals to calculate areas of bounded regions.

- Gain proficiency in evaluating improper integrals and understanding their convergence properties.
- Understand the convergence and divergence of numerical series and be able to apply various convergence tests.

b. PIs addressed by the course:

PI	1.3
Covered	x
Assessed	x

7. Brief list of topics to be covered

- Introduction to function approximation and local behavior (2 lectures)
- Taylor and Maclaurin series expansions (3 lectures)
- Applications of Finite Taylor expansions as computing limits (3 lectures)
- Manipulating antiderivatives and integration techniques (4 lectures)
- Evaluating definite integrals and calculating bounded areas (4 lectures)
- Types of improper integrals and their convergence properties (2 lectures)
- Nature of numerical series: Sequence of partial sums and their convergence (3 lectures)
- Various convergence tests: Ratio and root tests, equivalence, comparison (2 lectures)
- Alternating series and its convergence criteria (1 lecture)