General Analysis

1. **Course number and name:** 020ANGNI1/020GANNI1 General Analysis

2. **Credits and contact hours:** 6 ECTS credits, 3x1:15 contact hours

3. **Name of course coordinator:** Wafa Saoud

4. **Instructional materials:** Lecture notes and worksheets.

   References
   - Maths PCSI-PTSI, X. Oudot and V. Queffelec, 2014.

5. **Specific course information**
   a. **Catalog description:**
      This course covers the fundamental concepts of analysis, including limits, continuity, differentiation, sequences, sets of numbers, and differential equations. Its objective is to equip students with the necessary skills to effectively calculate limits, perform differentiation and solve linear differential equations of both first and second order. In addition, this course allows the development of mathematical reasoning skills. Students learn to formulate coherent arguments, justify calculation steps and prove mathematical results.
      At the end of this course, the students will have gained a solid foundation in analysis enabling them to pursue more advanced courses in mathematics, physics and engineering.

   b. **Prerequisites:** None

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

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
      - Recognize the transcendental functions, such that the logarithmic and exponential functions, the power functions, the inverse trigonometric functions and the hyperbolic functions.
      - Study the variations of the transcendental functions.
      - Solve equations involving transcendental functions.
      - Study the continuity and differentiability of the transcendental functions.
      - Find the nth derivative.
      - Learn and apply Rolle's Theorem and the mean value theorem.
      - Study the nature of convergence of sequences.
      - Recognize the subsequences and the adjacent sequences, and conclude.
      - Solve linear differential equations of first order.
      - Solve second order linear differential equations with constant coefficients

- Identify rational and irrational numbers.
- Recognize and determine upper and lower bounds, infimum and supremum in $\mathbb{R}$.
- Understand the concept of the extended real number line.
- Know and prove properties of the absolute value and floor functions.

b. PI addressed by the course:

PI	1.3
Covered	x
Assessed	x

7. Brief list of topics to be covered

- Chapter 1: Preliminaries, logarithmic and exponential functions + Worksheet 1: Ex 1→ 4 (3 lectures)
- Chapter 1: Power functions + Worksheet 1: Ex 5 → 7 (2 lectures)
- Chapter 1: Inverse trigonometric functions + Worksheet 1: Ex 8 → 11 (3 lectures)
- Chapter 1: Hyperbolic functions + Worksheet 1: Ex 12 and 13 (2 lectures)
- Chapter 2: Limits and continuity + Worksheet 2: Ex 1→ 3 (4 lectures)
- Chapter 2: Differentiability + Worksheet 2: Ex 4 → 8 (5 lectures)
- Chapter 3: Introduction, limits of numerical sequences + Worksheet 3: Ex 1 → 3 (4 lectures)
- Chapter 3: Subsequences, adjacent sequences + Worksheet 3: Ex 4 → 6 (2 lectures)
- Chapter 4: Linear differential equations of first order + Worksheet 4: Ex 1→ 5 (3 lectures)
- Chapter 4: Linear second order differential equations with constant coefficients + Worksheet 4: Ex 6 → 8 (3 lectures)
- Chapter 5: Sets of numbers + Worksheet 5: Ex 1 → 3 (2 lectures)
- Chapter 5: Properties in the set of real numbers + Worksheet 5: Ex 5 → 9 (1 lecture)
- Supplementary exercises (2 lectures)