CALCULUS 1

Course Syllabus

1. General Information

Course name: Calculus 1

Course code: BAS1203

Number of credits: 3

2. Objectives

- Knowledge:
  - Equip students with basic knowledge of the differential and integral calculus of functions of one variable as a basis for further learning Calculus 2, Physics, Probability and Statistics, Engineering mathematics and other subjects.
  - Including the main contents as follows: Real numbers, complex numbers, the limit of sequences and functions, the continuity of functions, differential and integral calculus, series of numbers, series of functions, power series and Fourier series.
- Skills:
  - Critical thinking and analytical thinking.
  - Skills of the differential calculation of one variable such as finding the limit of a sequence of numbers (or the convergence of iteration sequences in optimization algorithms), of functions, finding the derivative and integral of one variable, applying derivatives and integrals, computing series of numbers, series of functions, power series, Fourier series and the convergent domaine of power series.
  - Applying analytical tools to their professional issues.
- Attitude:
  - Prepare lessons seriously before going to class, listen to lectures actively in class, practice above skills consciously.
  - Complete exercises, midterm tests, and assignments.

3. Abstract

Provide students with basic knowledge about the set of numbers, sequences of numbers, functions, the differential and integral calculus of functions of one variable and the theory of series.

4. Teaching and learning methods

Lectures: 34h

Classroom guidance:	8h
Class discussion:	00h
Midterm test:	02h
Group activities:	00h
Self-study:	01h

5. Prerequisites

Elementary mathematics

6. Learning Outcomes

Upon successful completion of the course, students will be able to:

1. Understand the differential and integral calculus of functions;
2. Use calculus tools to solve problems.

7. Assessment Criteria

Learning outcomes Upon successful completion of the course, a learner will	**Assessment criteria for pass**
LO1: Understand the differential and integral calculus of functions	- Real numbers, complex numbers - the limit of sequences and functions, the continuity of functions, differential and integral calculus, - series of numbers, series of functions, power series and Fourier series.
LO2: Use calculus 1 tools to solve problems	- computing series of numbers, series of functions, power series, Fourier series and the convergent domaine of power series. - finding the derivative and integral of one variable - applying derivatives and integrals.

8. Outlines

Chapter 1 The limit and continuity of functions of one variable

1.1. The set of real and complex numbers

1.2. Definition of functions of one variable, function composition, inverse functions, elementary functions.

1.3. Definition of the limit, properties of the limit, operations of the limit.

1.4. Infinitesimal calculus

1.5. Indeterminate form

1.6. Continuous functions: Definition and properties

Chapter 2 Differential calculus of functions of one variable

2.1 Concept of derivative.

2.1.1 Definition of derivative. The mechanical and geometrical meaning of derivative

2.1.2 Derivative of elementary functions

2.1.3 Basic derivative rules

2.2 Concept of differentiation. Use the differential to approximate the value of functions

2.3 Higher-order derivatives and differentiations. Leibniz's formula

2.4 Mean value theorems

2.4.1 Rolle's theorem

2.4.2 Lagrange's theorem

2.4.3 Cauchy's theorem

2.5 Taylor's formula. Maclaurin's formula

2.6 Applications of derivative

2.6.1 L'Hospital's rule

2.6.2 Extreme value of functions

Chapter 3 Integral calsulus of functions of one variable

3.1. Indefinite integrals

3.1.1. Antideravitive of elementary functions

3.1.2. Integration by parts and change of variables

3.1.3. Integration of rational functions and some related integrals

3.2. Definite integral

3.2.1. Definition of definite integrals and integrability conditions.

3.2.2. The basic properties of definite integrals

3.2.3. Newton-Leibniz's formula

3.2.4. Determining integral calculus.

3.3 Applications of definite integrals

3.3.1 Application in finding areas

3.3.2 Application in finding volumes

3.3.3 Application in finding arc length

3.3.4 Application in finding the surface area of a surface of revolution.

3.4 Improper integrals

3.4.1 Type 1

3.4.2 Type 2

Chapter 4 Series theory

4.1 Series of number.

4.1.1. Necessary and sufficient conditions of convergence

4.1.2 Positive sequence. Convergent criteria: Comparative criterion, D'Alembert's criterion, Cauchy's criterion, integration criterion.

4.1.3 Alternating series. Leibniz's criterion.

4.1.4 Absolute and conditional convergence

4.2 Power series. Taylor's series. MacLaurin's series

4.3 Fourier series.

9. Required textbooks

[1] P.N. Anh, *Lectures on Analysis 1*; Posts and Telecommunications institute of Technology, 2009.

10. Suggested textbooks

[2] N.D. Tri et al., *Advanced mathematics 2*, Vietnam Education Publishing House, 1996.

[3] N.D. Tri et al., *Exercises in advanced mathematics*, Vietnam Education Publishing House, 1997.

[4] N. D. Tri et al., *Advanced mathematics 1*, Vietnam Education Publishing House, 2003.

[5] D. Trim; *Calculus for engineers*, Springer, 2001.

[6] J. Stewart; *Mathematical analysis*, (2006a) Cambridge: Cambridge University Press.

11. Grading policy:

- Attendance: 10%
- Exercise: 10%
- Mid-term test: 10%
- Final examination: 70%

Lecturer	**Head of Department of Mathematics**
Assoc. Prof. Dr. Pham Ngoc Anh	**Assoc. Prof. Dr. Pham Ngoc Anh**