MI1114E CALCULUS 1

Version: 2024.2.0

Objective: This course provides fundamental knowledge about calculus for single and multivariable functions needed to study further mathematics as well as engineering subjects. Students will be provided a mathematical foundation to succeed in the fields of Technology, Engineering and Economics.

Contents: Limits and continuity. Derivatives and differentials of functions of single variable and multivariables, integrals of functions of single variable.

1. GENERAL INFORMATION

Course title: Calculus 1

Course ID: MI1114E

Course Units: 3(2-2-0-6)

- Lecture: 30 hours
- Seminars: 30 hours

Previous module: -

Prerequisites: -

Companion module: None

2. DESCRIPTION

An introduction to the basic ideas and techniques of differential and integral calculus. Topics include differentiation and integration of functions of a single variable, differentiation of functions of several variables, partial derivatives.

3. OBJECTIVES AND EXPECTED OUTCOMES

Students who complete this module have the abilities to:

Objectives	Objectives description/Expected Outcomes	Outcome standard allocated for modules/ Levels (I/T/U)
[1]	[2]	[3]
M1	**Master the basic knowledge of calculus 1 and apply in practice to solve related exercises**	
M1.1	Master the basic concepts of analysis 1 such as: limit of sequences, limit of functions, continuous functions, higher order derivatives and differentials, extremals of single- variable functions and multi-variable functions; antiderivative and integral of single-variable functions	I/T
M1.2	Be able to apply the knowledge to solve exercises	T/U
M2	**Achieve serious attitude and necessary skills for highly effective work**	

Objectives	Objectives description/Expected Outcomes	Outcome standard allocated for modules/ Levels (I/T/U)
M2.1	Be skilled at analyzing and solving problems with strong logical thinking; working independently and staying focused	T/U
M2.2	Identify some practical problems that can be solved by using tools of calculus	I/T/U
M2.3	Gain serious working attitude, proactive creativity, adaptation to highly competitive working environment	I/T

4. COURSE MATERIALS

Textbooks

[1] James Stewart (2016). Calculus: Concepts and Contexts, eighth edition. Thomson, Brooks/Cole Publishing Company.

[2] Nguyễn Đình Trí, Trần Việt Dũng, Trần Xuân Hiển, Nguyễn Xuân Thảo (2023). *Toán học cao cấp tập 2: Giải tích.* NXB Giáo dục.

[3] Nguyễn Đình Trí, Trần Việt Dũng, Trần Xuân Hiển, Nguyễn Xuân Thảo (2023). *Bài tập Toán học cao cấp tập 2: Giải tích.* NXB Giáo dục.

References

[1] Trần Bình (1998). *Giải tích I: Phép tính vi phân và tích phân của hàm một biến*. NXB Khoa học và kỹ thuật, Hà Nội.

[2] Trần Bình (2005). *Giải tích II và III: Phép tính vi phân và tích phân của hàm nhiều biến*. NXB Khoa học và kỹ thuật, Hà Nội.

[3] Đoàn Công Định, Trịnh Ngọc Hải, Phạm Thị Hoài, Trần Ngọc Thăng, Nguyễn Thị Toàn (2021). *Bài giảng Giải tích 1.* NXB Bách Khoa Hà Nội.

5. ASSESSMENT

Components	Evaluation method	Description	Assessed expected outcomes	Proportion
[1]	[2]	[3]	[4]	[5]
A1. The process mark				**50%**
A1.1. Attendance and performance *	Attendance and performance in class		M2.3	**10%**
A1.2. Continuous assessment	Continuous assessment test	Online multiple choice tests	M1.1, M1.2	**10%**
A1.3. Midterm exam	Midterm exam **Content: From the 1st**	Multiple choice and	M1.1, M1.2,	**30%**

	week to the 7th week	constructed response test	M2.1, M2.2, M2.3	
A2. Final exam	**Final exam**	Essay	M1.1, M1.2, M2.1, M2.2, M2.3	**50%**

** Attendance and performance in class are evaluated according to the Rule of Faculty of Mathematics and Informatics accompanied with the Regulations of Higher Education of Hanoi University of Science and Technology.*

6. KẾ HOẠCH GIẢNG DẠY (chưa thay đổi, cần chỉnh sửa)

Week	Topics	Objective	Activities	Exercises
[1]	[2]	[3]	[4]	[5]
1	**Chapter 1: Differentiation of functions of single variable** **1.1.** Concepts of functions - Definition of a function, domain and range. - Bounded functions, monotone functions, periodic functions, composite functions.	M1.1 M1.2 M2.1 M2.3	Lecturer: - Self-introduce - Introduce the course outline - Explain teaching and learning methods; and forms of subject assessment - Lecture, exchange questions and answers with students during the lecture Student: - Read in advance the next lesson - Master the basic concepts and apply to solve exercises according to	A1.1, A1.2, A1.3, A2

Week	Topics	Objective	Activities	Exercises
[1]	[2]	[3]	[4]	[5]
			the content and progress of the subject	
2	- Inverse function - Elementary functions. **1.2.** Limit of a function - Definition, uniqueness of limit of a function - Left hand and right hand limits, limit at infinity		Lecturer: - Lecture, exchange questions and answers with students during the lecture Student: - Read in advance the next lesson - Master the basic concepts and apply to solve exercises as well as some practical models connected with the subject	A1.1, A1.2, A1.3, A2
3	- Limit laws - Infinite limit - Concept of infinitesimal and infinity.			A1.1, A1.2, A1.3, A2
4	**1.3.** Continuity of a function - Definition - Left hand and right hand continuity - Continuity of composite and inverse function - Uniform continuity			A1.1, A1.2, A1.3, A2
5	- Theorems of continuous functions. **1.4.** Derivative and differential of a function - Definition of derivative, differential			A1.1, A1.2, A1.3, A2
6	- Differentiation rules, chain rule and differentiation of inverse functions - Derivatives of elementary functions	M1.1 M1.2 M2.1 M2.2 M2.3		A1.1, A1.2, A1.3, A2
7	- Higher order derivatives and higher order differentials - Mean value theorems	M1.1 M1.2 M2.1 M2.3		A1.1, A1.2, A1.3, A2
8	- L'Hospital rule - Finite expansion formula of a function.	M1.1 M1.2 M2.1 M2.2 M2.3		A1.1, A1.2, A2

Week	Topics	Objective	Activities	Exercises
[1]	[2]	[3]	[4]	[5]
9	**1.5.** Scheme of surveying a function	M1.1 M1.2 M2.1 M2.3	Lecturer: - Lecture, exchange questions and answers with students during the lecture Student: - Read in advance the next lesson - Master the basic concepts and apply to solve exercises as well as some practical models connected with the subject	A1.1, A1.2, A2
10	**Chapter 2: Integration of functions of single variable** **2.1.** Indefinite integrals - Definition. Linearity of integration - Integrals of elementary functions - Integration by parts - Change of variables formulae - Integration of rational functions.			A1.1, A1.2, A2
11	**2.2.** Definite integrals - Definition, geometric and mechanical interpretations - Criteria for integrability. Properties - Fundamental theorem of calculus. Newton-Leibniz formula - Techniques of integration.	M1.1 M1.2 M2.1 M2.2 M2.3		A1.1, A1.2, A2
12	**2.3.** Applications of definite integrals - Areas of planar regions - Volumes of solids and of solids of revolution - Arc-lengths - Areas of surfaces of revolution.	M1.1 M1.2 M2.1 M2.3		A1.1, A1.2, A2
13	**Chapter 3: Functions of Several Variables** **3.1.** Functions of several variables - Domain, distance, neighborhood, boundary, closed and open sets, bounded sets - Definition of functions of multivariable, geometric interpretation, domain and range - Limit of functions of multivariables - Continuity			A1.1, A1.2, A2
14	**3.2.** Partial derivatives and total differentials - Partial derivatives: definition, differentiation rules, chain rule - Total differential: definition, approximation by differentials	M1.1 M1.2 M2.1 M2.2 M2.3		A1.1, A1.2, A2

Week	Topics	Objective	Activities	Exercises
[1]	[2]	[3]	[4]	[5]
	- Higher order derivatives and higher order differentials - Taylor expansion			
15	**3.3.** Extrema of functions of multi-variables - Extrema - Constrained extrema (self-study) - Maxima and minima.			A1.1, A1.2, A2
16	Summary and revision			

7. RULES OF THE MODULE

8. DATE OF APPROVAL: ……..

Faculty of Mathematics and Informatics