

Mục tiêu: Cung cấp cho sinh viên những kiến thức cơ bản về phép tính vi phân, tích phân của hàm một biến số, phép tính vi phân của hàm nhiều biến. Trên cơ sở đó, sinh viên có thể học tiếp các học phần sau về toán cũng như các môn kỹ thuật khác, góp phần tạo nên nền tảng toán học cơ bản cho sinh viên.

Objective: To provide the knowledge on calculus of single variable functions and multi-variables functions. To formulate Mathematical foundations for students, providing mathematical tools and modeling for students to use in practical problems.

Nội dung: Hàm một biến: giới hạn, tính liên tục, đạo hàm, tích phân. Hàm nhiều biến: định nghĩa, giới hạn, tính liên tục, đạo hàm, cực trị.

Contents: Single variable functions: limit, continuity, derivative, integral. Multi-variable functions: definitions, limit, continuity, derivative, extremum.

1. GENERAL INFORMATION

Course title:	Calculus I
Course ID:	MI1110Q
Course Units:	3(2-2-0-6)
	- Lecture: 30 hours
	- Seminar: 30 hours

Previous module:

Prerequisites:

Companion module:

2. DESCRIPTION:

An introduction to the basic ideas and techniques of differential and integral calculus. Topics include differentiation and integration of functions of one variable, differentiation of functions of several variables, partial derivatives, Lagrange's multipliers.

3. OBJECTIVES AND EXPECTED OUTCOMES

Students who complete this module have the abilities to:

Objectives	Objectives description/Expected Outcomes	Proportional Outcomes (I/T/U)
M1	Students can solve basic problems of the subject	
M1.1	Students can solve problems on differentiation and integration of functions of one variable.	T
M1.2	Students can solve problems on differentiation of functions of several variables.	T
M2	Students can apply the subject's knowledge to practical problems	
M2.1	Students can solve practical problems involving functions of one variable.	I
M2.2	Students can solve practical problems involving functions of several variables.	I

4. COURSE MATERIALS

Textbooks

- [1] Nguyễn Đình Trí, Trần Việt Dũng, Trần Xuân Hiền, Nguyễn Xuân Thảo (2015). *Bài tập Toán học cao cấp tập I*. NXB Giáo dục.
- [2] Nguyễn Đình Trí, Tạ Văn Đĩnh, Nguyễn Hồ Quỳnh (2000). *Bài tập Toán học cao cấp tập II*. NXB Giáo dục.

References

- [1] James Stewart (2016). *Calculus: Concepts and Contexts, eighth edition*. Thomson, Brooks/Cole Publishing Company
- [1] Trần Bình (2005). *Giải tích I*, NXB KH và KT.
- [2] Lê Ngọc Lăng, Nguyễn Chí Bảo, Trần Xuân Hiền, Nguyễn Phú Trường. *Ôn thi học kỳ và thi vào giai đoạn II*. NXB Giáo dục.
- [3] Lê Ngọc Lăng, Tống Đình Quỳ, Nguyễn Đăng Tuấn, Mai Văn Dược (1998). *Giúp ôn tập tốt môn Toán cao cấp*. NXBKH.

5. ASSESSMENT

Components	Evaluation method	Description	CDR được đánh giá	Proportion
[1]	[2]	[3]	[4]	[5]
A1. Attendance point	A1.1. Learning attitude	Attendance check		20%
A2. Mid-term test (*)	A2.1. 1-st <i>Mid-term test (MTT1)</i> (Content: weeks 1-5)	Multiple-choice test	M1.1, M1.2, M2.1, M2.2, M2.3	30%
	A2.2. 2-nd <i>Mid-term test (MTT2)</i> (Content: weeks 6-10)			
A3. Final exam	Final exam	Quizzes/Essay	M1.1, M1.2, M2.1, M2.2, M2.3	50%

(*) The Mid-term test point ($=1/3(MTT1+MTT2)$) is adjusted by adding points for the performance of students during the course. These points vary from -1 to +1 according to the Regulations of Higher Education of Hanoi University of Science and Technology.

6. COURSE PLAN

Week	Topics	Objective	Activities	Test/Exam
[1]	[2]	[3]	[4]	[5]
1	Chapter 1. Single variable functions 1.1 Introduction 1.2 Definition of functions, composite functions, inverse functions		lecture	A 2.1, A3

Week	Topics	Objective	Activities	Test/Exam
[1]	[2]	[3]	[4]	[5]
	1.3 Elementary functions 1.4 Sequences: definitions, properties, Cauchy's criterion.			
2	1.5 Limits of functions: definitions, properties, one sided limits, limits at infinity, infinite limits. 1.6 Infinites and infinitesimals 1.7 Continuous functions: continuity, one side continuity, uniform continuity, points of discontinuity.		lecture	A 2.1, A3
3	1.8 Derivatives and differentials: - Definitions - One side derivatives. Relationship between derivative and one side derivatives, relationship between derivative and continuity. - Derivative of composite functions and inverse functions - Differentials: definition, geometric meaning, application to approximation. Relationship between derivative and differential.		lecture	A 2.1, A3
4	- High order derivatives and differentials. 1.9 Mean value theorems and applications		lecture	A 2.1, A3
5	- Taylor's, Maclaurin's formulas - L'Hospital's rule - Monotonic of functions - Extrema of functions		lecture	A 2.1, A3
6	1.10 Analyzing a function with its derivative		lecture	A 2.2, A3
7	Chapter 2. Integration of functions 2.1 Indefinite integral: - Definitions, properties. Basic integration rules. - Indefinite integral of rational functions		lecture	A 2.2, A3
8	- Indefinite integral of rational functions, irrational functions, trigonometric functions, transcendental functions. 2.2 Definite integral: - Definitions, properties, geometric meaning. Basic integration rules.		lecture	A 2.2, A3
9	Mid term break			

Week	Topics	Objective	Activities	Test/Exam
[1]	[2]	[3]	[4]	[5]
10	- Newton- Leibniz formula - Techniques of Integration - Definite integral of some class of functions (rational functions, irrational functions, trigonometric functions, transcendental functions).		lecture	A 2.2, A3
11	2.3 Applications of definite integrals: area between two curves, volumes, length of a plane curve, area of a surface of revolution.		lecture	A3
12	2.4 Improper integral: Definitions, computing improper integral, convergence tests		lecture	A3
13	Chapter 3 Multi-variable functions 3.1 Basic concepts: - Distance, boundary of sets, closed, open sets, bounded sets - Multi-variable functions: definitions, geometric meaning, domain, range. - Limits of functions: definitions, properties - Continuous functions: definitions, properties		lecture	A3
14	3.2 Partial derivatives and differential: - Partial derivatives: Definition, rules of calculation - Differential: Definition, relationship between differentiability and partial derivatives. Application to approximation. - Higher order partial derivatives and differentials. - Taylor and Maclaurin formulas		lecture	A3
15	3.3 Extrema: - Definitions and finding rule of extrema.		lecture	A3
16	- Constrained extrema. - Maximum and minimum value.		lecture	A3

7. RULES OF THE MODULE

8. DATE OF APPROVAL:

School of Applied Mathematics and Informatics