MI1026 CALCULUS 2

Version: 2024.1.0

Objective: This is the second course in calculus. It covers basic notions of multiple integrals: double integrals, double integrals in polar coordinates, triple integrals, triple integrals in cylindrical and spherical coordinates, line integrals, surface integrals, with variety applications in vector field studies, in mechanics, in electrics, in physics, ...

Contents: Applications of differential calculus, vectors, cylindrical and spherical coordinates, double integrals, triple integrals, line integrals, surface integrals and vector fields.

1. GENERAL INFORMATION

Course title:	**Calculus 2**
Unit in charge:	Faculty of Mathematics and Informatics
Course ID:	MI1026
Course Units:	4(3-2-0-8) - Lecture: 45 hours - Seminars: 30 hours
Previous module:	MI1016
Prerequisites:	-
Companion module:	MI1036

2. DESCRIPTION

An introduction to the basis ideas and techniques of applications of differential calculus to geometry, vectors, cylindrical and spherical coordinates, double integrals, triple integrals, line integrals, surface integrals and vector fields.

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 basic calculus for functions of many variables and apply in practice to solve related problems**	
M1.1	Master the basic concepts of Calculus 2 such as: double integrals, triple integrals, line integrals, surface integrals, field theory, and applications of calculus.	I/T
M1.2	Be able to apply the knowledge to solve exercises	T/U
M2	**Hold a serious attitude and necessary skills for highly effective work**	
M2.1	Be skilled at analyzing and solving problems with strong logical thinking; working independently and staying	T/U

Objectives	Objectives description/Expected Outcomes	Outcome standard allocated for modules/ Levels (I/T/U)
	focused.	
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 (2020). *Calculus: Concepts and Contexts, ninth edition*. Thomson, Brooks/Cole Publishing Company.

References

[1] Nguyễn Đình Trí, Trần Việt Dũng, Trần Xuân Hiển, Nguyễn Xuân Thảo (2015). *Toán học cao cấp tập 2: Giải tích.* NXB Giáo dục.

[2] Nguyễn Đình Trí, Trần Việt Dũng, Trần Xuân Hiển, Nguyễn Xuân Thảo (2017). *Bài tập Toán học cao cấp tập 2: Giải tích.* NXB Giáo dục.

[3] Trần Thị Kim Oanh, Phan Xuân Thành, Lê Chí Ngọc, Nguyễn Thị Thu Hương (2022), *Giải tích II: Hàm số nhiều biến số (bài giảng dành cho sinh viên các trường kĩ thuật)*, NXB Bách Khoa Hà Nội.

[4] Khoa Toán – Tin (2023): *Slides bài giảng Giải tích II* (tài liệu lưu hành nội bộ).

5. ASSESSMENT

Components	Evaluation method	Description	Rated outcome standards	Proportion
[1]	[2]	[3]	[4]	[5]
A1. Attendance mark	**A1.** Learning attitude	Attendance check		**20%**
A2. Process mark (*)	**A2.1.** Midterm exam 1 (KT1 points on the 15-point scale) (Contents: from week 1 to week 5)	Multiple-choice	M1.1, M1.2, M2.1, M2.2, M2.3	**30%**
	A2.2. Midterm exam 2 (KT2 points on the 15-point scale) (Contents: from week 6 to week 10)			
A3. Final exam mark	**A3. Final exam**	Essay	M1.1, M1.2, M2.1, M2.2, M2.3	**50%**

(*) *The process mark is one third of the sum of the two midterm exams' marks. The process mark 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	Exercises
[1]	[2]	[3]	[4]	[5]
1	**Chapter 1: Vectors and the geometry of space** **1.1.** Vectors - Definitions and properties - The dot product - The cross product **1.2.** Equations of lines and planes - Equations of lines - Equations of planes	M1.1 M1.2 M2.1 M2.2 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 the content and progress of the subject	A1 A2.1, A3
2	**1.3.** Cylinder and quadric surfaces - Cylinder surfaces - Quadric surfaces **1.4.** Cylindrical and spherical coordinates - Cylindrical coordinates - Spherical coordinates	M1.1 M1.2 M2.1 M2.2 M2.3	- 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 A2.1, A3
3	**Chapter 2: Vector Functions** **2.1.** Vector functions **2.2.** Space curves **2.3.** Derivatives and Integrals of vector functions - Derivatives. - Integrals	M1.1 M1.2 M2.1 M2.2 M2.3		A1 A2.1, A3
4	**2.4.** Arc Length and Curvature. - Arc Length. - Curvature. - The normal and binormal	M1.1 M1.2 M2.1 M2.2		A1 A2.1, A3

Week	Topics	Objective	Activities	Exercises
[1]	[2]	[3]	[4]	[5]
	vectors. **2.5.** Motion in space. - Velocity. - Acceleration - Curvature	M2.3		
5	**Chapter 3: Double Integrals** **3.1.** Definitions and properties. **3.2.** Volumes and double integrals.	M1.1 M1.2 M2.1 M2.2 M2.3		A1 A2.1, A3
6	**3.3.** The Midpoint Rule for double integrals. **3.4.** Iterated Integrals.	M1.1 M1.2 M2.1 M2.2 M2.3		A1 A2.2 A3
7	**3.5.** Double Integrals in polar coordinates. **3.6.** Applications of double integrals: - Area, - Volume.	M1.1 M1.2 M2.1 M2.2 M2.3		A1 A2.2 A3
8	- Moments and centers of mass, - Moment of inertia, - Surface area. **3.7.** Change of variables in double integrals	M1.1 M1.2 M2.1 M2.2 M2.3		A1 A2.2 A3
9	**Chapter 4: Triple Integrals** **4.1** Definitions and properties. **4.2** Applications of triple integrals: volume, mass, moments and centers of mass, moment of inertia. Triple integrals in cylindrical and spherical coordinates.	M1.1 M1.2 M2.1 M2.2 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 A2.2 A3
10	**4.4.** Change of variables in triple integrals.	M1.1 M1.2 M2.1 M2.2	Lecturer: - Lecture, exchange questions and answers	A1 A2.2 A3

Week	Topics	Objective	Activities	Exercises
[1]	[2]	[3]	[4]	[5]
	Chapter 5: Line Integrals **5.1.** Line integrals. - Line integrals in plane. **4.3** Line integrals in space.	M2.3	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	
11	**5.2.** Vector fields. **5.3.** Line integrals of vector fields. **5.4.** The Fundamental Theorem for line integrals. - **5.5.** Independent of path.	M1.1 M1.2 M2.1 M2.2 M2.3		A1 A3
12	**5.6.** Green's theorem. **5.7.** Curl and Divergence. - Curl. - Divergence. Vector form of Green' theorem.	M1.1 M1.2 M2.1 M2.2 M2.3		A1 A3
13	**Chapter 6: Surface Integrals** **6.1.** Surface integrals. **6.2.** Applications of Surface Integrals. - Surface area. Surface mass.	M1.1 M1.2 M2.1 M2.2 M2.3		A1 A3
14	**6.3.** Oriented surfaces. **6.4.** Surface integrals of vector fields.	M1.1 M1.2 M2.1 M2.2 M2.3		A1 A3
15	**6.5.** Stock' theorem. **6.6.** The divergence theorem.	M1.1 M1.2 M2.1 M2.2 M2.3		A1 A3
16	***Summary and revision***			A1 A3

7. RULES OF THE MODULE

8. DATE OF APPROVAL:

Faculty of Mathematics and Informatics