Program Mathematics Unit

Syllabus of Course 90902

Differential and Integral Calculus2

Academic Year	**2025**
No. of course hours	**6.00 Semestrial hours [Lecture 4.00 + tutorial -2.00]**
Academic credits	**5.00**
Prerequisites	**Pre: 90901 Differential and Integral Calculus1** **Pre: 90905 Linear Algebra**
Please note that **The prerequisites are for all programs, you are required to be updated on the prerequisites you need according to your personal program.**	
Class Attendance	**Not mandatory**
Objectives	**The course presents the basic concepts and methods of multivariable calculus as well its applications in science and engineering.**
Abstract	**Infinite series. Convergence tests. Series of functions; convergence and uniform convergence. Power series; representation of f unctions by power series. Taylor series. Functionsof several variables- limits and continuity, partial and directional derivatives, Linear approximation, Gradient. The chain rule. Higher order partial derivatives and second degree Taylor polynomial. Relative/absolute maximum and minimum values. Lagrange multipliers. Multiple integrals. Fubini's theorem. Change of variables. Polar, cylindrical and spherical coordinates. Line integrals of scalar functions. Line integrals of vector fields. Independence of path and Green theorem. Surface integrals of scalar functions. Oriented surfaces**

	and surface integrals of vector fields. The divergence theorem (Gauss-Ostrogradsky). Stokes' theorem. Applications.

Academic learning outcomes

Learning outcomes related to the content of the course	**This course is designed to give students the mathematical background and the tools they need in engineering studies, in the field of differential and integral calculus in several variables and thus completes the fundamental topics of infinitesimal calculus.**

Learning outcomes - Skills

Integrative learning: linking to practical experience. The ability to identify connections between experience and similarly perceived ideas.
Problem solving: defining problems and identifying strategies. The ability to identify one or more approaches to problem solving without application in a specific context.
Critical thinking: explaining the issues, foundation, contexts, and taking a position. Presenting the subject based on information sources without interpretation, evaluation or taking a position.

Further points of emphasis	

Lecture topics by weeks

The order of the topics can be changed at the lecturer's discretion.

1	**Infinite series and tests of convergence (1) :** **Infinite series. Convergence tests. The comparison, ratio and root tests. The integral test.**
2	**Infinite series and tests of convergence (2) :** **Alternating series; Leibniz's test; absolute and conditional convergence.** **Series of functions. Power series (1):**

	Series of functions; convergence and uniform convergence; Weierstrass test for uniform convergence (if time allows). Power series; **representation of function by power series.**
3	**Series of functions. Power series (2):** **Taylor and Mac-Laurin series. Cauchy-Hadamrd theorem. Differentiation and integration of power series. Applications.** **Functions of several variables (1):** **examples; domain, range and level curves. Limits and continuity.**
4	**Functions of several variables (2):** **Partial derivatives. Differentials and linear approximation. Gradients and directional derivatives. The chain rule; application to differential equations. Higher order partial derivatives.**
5	**Taylor polynomial. Relative/absolute minimum and maximum points (1):** **Second degree Taylor polynomial and quadratic approximation of functions of two or more variables. Relative/absolute maximum and minimum values; critical points and Fermat's theorem.**
6	**Relative/absolute minimum and maximum points (2):** **Second derivatives test; saddle points. Weierstrass theorem. Lagrange multipliers. Applications.**
7	**Multiple integrals (1):** **Multiple integrals; iterated integrals; Fubini's Theorem. Polar, cylindrical and spherical coordinates. The Jacobian and Change of variables. Applications of double and triple integrals.**
8	**Multiple integrals (2):** **Multiple integrals; iterated integrals; Fubini's Theorem. Polar, cylindrical and spherical coordinates. The Jacobian and Change of variables. Applications of double and triple integrals.**
9	**Multiple integrals (3):** **Multiple integrals; iterated integrals; Fubini's Theorem. Polar, cylindrical and spherical coordinates. The Jacobian and Change of variables. Applications of double and triple integrals.**

10	**Line integrals and Surface integrals (1):** **Line integrals of scalar functions. Line integrals of vector fields; work. The fundamental theorem for line integrals and independence of path.**
11	**Line integrals and Surface integrals (2):** **Green's theorem. Surfaces. Tangent planes, normal lines and gradient vectors. Surface integrals of scalar functions. Oriented surfaces and surface integrals of vector fields. Flux.**
12	**Gauss Theorem and Stokes Theorem (1):** **Divergence and curl. The divergence theorem (Gauss-Ostrogradsky). Applications.**
13	**Gauss Theorem and Stokes Theorem (2):** **Stokes' theorem. Applications.**

Tutorials / Labs topics by weeks

The order of the topics can be changed at the lab instructor's / tutor's discretion.

1	**Infinite series. Convergence tests.**
2	**Power series (1)**
3	**Power series (2)** **Functions of several variables; examples; domain, range and level curves.**
4	**Limits and continuity. Partial derivatives. Higher order partial derivatives.**
5	**Gradients and directional derivatives. Differentials and linear approximation. The chain rule.**
6	**The chain rule; application to differential equations. Relative/absolute maximum and minimum values; critical points and Fermat's theorem. Weierstrass theorem. Applications.**
7	**Second derivatives test; Hessian and saddle points. Lagrange multipliers. Applications.**
8	**Multiple integrals and applications. Fubini's theorem. Jacobian (1)**
9	**Multiple integrals and applications. Fubini's theorem. Jacobian (2)**
10	**Multiple integrals and applications. Fubini's theorem. Jacobian (3)**
11	**Line integrals of scalar functions. Line integrals of vector fields; work. The fundamental theorem for line integrals and independence of path. Green's theorem.**

12	Surfaces. Tangent planes, normal lines and gradient vectors. Surface integrals of scalar f unctions.
13	Surface integrals of vector fields. The divergence theorem (Gauss-Ostrogradsky) and Stokes' theorem. Applications.

Course coordinator	Prof. Stancescu Yoni
Language of instruction	Hebrew
Subjects for self-tutoring	
Textbooks and Recommended Bibliography	ה. אנטון, "חשבון דיפרנציאלי ואינטגרלי א", האוניברסיטה הפתוחה, תל אביב, 1997. ב. צ. קון-ס. זעפרני, "חשבון דיפרנציאלי ואינטגרלי 1", הוצאת בק – ספרי לימוד, חיפה, 1994. Thomas, G.B and Finney, R.L.: Calculus, 14th ed., Addison-Wesley, 2018.

Course Requirements and Calculation of Final Grade

Task Type	Percentage of Final Grade
Final Exam Grade	85
Midterm Exam Grade	10
Homework Assignments	5
A project in a course where there is no Final Exam	0
A project in a course where there is a Final Exam	0
Final Grade	0

Clarification to pass the course:

In order to pass the course, students must fulfill the following conditions [excluding the English Beginners Course, Labs and Workshops]:

1. Final course grade of at least 60 [taking into consideration all the above course requirements].
2. Attendance according to the attendance requirement [see section regarding attendance].

Exam and Midterm Exam

Type of Midterm Exam	**Moodle (remotely)**
Duration of Midterm Exam	
Location of Midterm exam	
Duration of Final Exam	**180 minutes**
Location of Final exam	**Regular class (no computers)**
Permitted Material/Tools for Exams	**Standard calculator**
Details of permitted materials for exam	
Formula Sheets	**Formula sheets written by the lecturer**
Number of single-sided sheets	