Politechnika Krakowska im. Tadeusza Kościuszki

Karta przedmiotu

obowiązuje studentów rozpoczynających studia w roku akademickim 2021/2022

Wydział Inżynierii Lądowej

Kierunek studiów: Budownictwo

Profil: Ogólnoakademicki

Forma sudiów: stacjonarne

Kod kierunku: BUD

Stopień studiów: I

Specjalności: Bez specjalności - studia w języku angielskim

1 Informacje o przedmiocie

Nazwa przedmiotu	Matematyka
Nazwa przedmiotu w języku angielskim	Mathematics
Kod przedmiotu	WIL BUD oIS B10 21/22
Kategoria przedmiotu	Przedmioty podstawowe
Liczba punktów ECTS	12.00
Semestry	1 2

2 Rodzaj zajęć, liczba godzin w planie studiów

Semestr	Wykład	Ćwiczenia audytoryjne	Laboratoria	Laboratoria komputerowe	Projekty	Seminarium
1	45	30	0	0	0	0
2	30	30	0	0	0	0

3 Cele przedmiotu

Cel 1 Introduction to mathematical analysis.

Cel 2 Introduction to linear algebra with geometry.

Cel 3 Introduction to the ordinary differential equations.

4 Wymagania wstępne w zakresie wiedzy, umiejętności i innych kompetencji

1 Znajomość matematyki w zakresie programu szkoły średniej.

5 Efekty kształcenia

EK1 Wiedza Znajomość definicji, twierdzeń i metod analizy matematycznej.

EK2 Umiejętności Rozwiązywanie zadań z analizy matematycznej.

EK3 Wiedza Znajomość definicji, twierdzeń i metod algebry liniowej.

EK4 Umiejętności Rozwiązywanie zadań z algebry liniowej.

EK5 Wiedza Znajomość definicji, twierdzeń i metod związanych z równaniami różniczkowymi.

EK6 Umiejętności Rozwiązywanie równań różniczkowych zwyczajnych.

6 Treści programowe

Wykład		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
W1	Infinite sequences and their limits, basic examples, the sandwich theorem for sequences, the nondecreasing sequence theorem.	3
W2	Functions of one real variable. Limits and continuity, inverse functions, composite functions, basic results on continuous functions, the definition of the derivative and interpretation, rules of differentiation, including chain rule, higher derivatives. Rolles theorem, the mean value theorem, Taylors theorem, l'Hopitals rule, extreme values of functions, monotonic functions, asymptotes, sketching graphs.	9
W3	Indefinite integrals. The definition of the indefinite integral, basic integration formulas. Methods of integration: substitution, by parts, integration of rational functions by partial fractions, trigonometric integrals.	6
W4	Matrices and determinants, systems of linear equations. The definition of a matrix, matrix operations. Determinants, basic properties, inverse matrices, singular matrices, simultaneous linear equations, Cramer's rule, the Kronecker-Capelli theorem.	6
W5	Elements of analytic geometry. Vector operations (addition, scalar product, dot product, cross product). Straight lines and planes in the 3-dimensional Euclidean space.	6
W6	Linear algebra. Vector spaces, linear independence of vectors, basis and dimension of a vector space, coordinate vectors, changing bases in vector spaces, linear transformations and their matrices, eigenvalues and eigenvectors, othonormal bases, Einstein summation convention, Cartesian tensors, operations on tensors.	9

Wykład		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
W7	Definite integrals. The definition of the definite integral, basic properties, the Fundamental Theorem of Calculus, applications of definite integrals, improper integrals.	6
W8	Complex numbers. Arithmetic operations with complex numbers, the modulus-argument form of a complex number, powers and roots.	3
W9	Functions of several variables. Limits and continuity, partial derivatives, directional derivatives, the total differential, the chain rule.Applications of partial derivatives. Higher-order partial derivatives, Taylor's theorem, local extreme values.Definite integrals. The definition of the definite integral, basic properties, the Fundamental Theorem of Calculus, applications of definite integrals, improper integrals.	6
W10	Double and triple integrals. The definition of the double and triple integrals, iterated integrals, Fubini's theorem, curvilinear coordinates, Jacobi's theorem.	6
W11	Line and surface integrals. The definition of the line integral of the first kind, basic properties and applications. The area of a surface, the definition of the surface integrals of the first kind, its applications. Line and surface integrals of the second kind. The definition of the line integral of the second kind, its physical meaning, the path independence principle, Greens theorem. The definition of the surface integrals of the second kind, Gausss theorem.	9
W12	Ordinary differential equations. First-order differential equations, particular and general solutions, the existence and uniqueness theorem, separation of variables, exact equations, linear equations. Second-order linear equations with constant coefficients, the characteristic equation, variation of parameters, undetermined coefficients, systems of linear differential equations.	6

Ćwiczenia audytoryjne		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
C1	Finding limits of sequences using theorems introduced in the lectures.	2
C2	Functions of one real variable, their domains and other properties, finding function limits and examination of continuity, practice in differentiation, using l'Hopital's rule to find limits, function examination, optimization problems.	6
C3	Indefinite integrals. Integration practice using the techniques introduced in the lectures.	4
C4	Operations on matrices, calculating determinants, solving systems of linear equations.	4
C5	Vector operations, dot and cross products and their applications, lines in space, equations of a plane, distances and symmetry of space objects: points, lines and planes.	4

Ćwiczenia audytoryjne		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
C6	Linear algebra: identifying vector spaces and subspaces, linear indendence of vectors, calculating coordinates of vectors in different bases, evaluating the matrix of a linear transformation in different bases, finding eigenvalues and eigenvectors, practice in operations on Cartesian tensors.	6
C7	Evaluating definite integrals, applications to computing the areas of domains, the arc length, the volume of a solid of revolution, examples of improper integrals.	4
C8	Complex numbers: practice following the concepts introduced in the lectures.	3
C9	Functions of two and three variables: limits, continuity, practice in partial and directional differentiation, finding local extreme values.	6
C10	Evaluating double integrals over rectangles and nonrectangular regions, computing triple integrals, geometrical and physical applications of multiple integrals.	6
C11	Evaluating line and surface integrals, computing the total mass of a weighted curve, the work done by a vector field along a path, conservative vector fields, applications of Gauss' theorem.	9
C12	Solving differential equations of various types, initial-value problems, solving systems of linear differential equations.	6

7 Narzędzia dydaktyczne

N1 Wykłady

N2 Zadania tablicowe

N3 Konsultacje

N4 Prezentacje multimedialne