GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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| Subject name and code | Mathematics_II, PG_00059255 | | | | | | |
| Field of study | Civil Engineering | | | | | | |
| Date of commencement of studies | October 2024 | | Academic year of realisation of subject | 2024/2025 | | | |
| Education level | first-cycle studies | | Subject group | Obligatory subject group in the field of study | | | |
| Mode of study | Part-time studies | | Mode of delivery | at the university | | | |
| Year of study | 1 | | Language of instruction | Polish | | | |
| Semester of study | 2 | | ECTS credits | 9.0 | | | |
| Learning profile | general academic profile | | Assessment form | exam | | | |
| Conducting unit | Mathematics Center -> Vice-Rector for Education | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | | dr Krzysztof Radziszewski | | | | |
| | Teachers | | | | | | |
| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 30.0 | 30.0 | 0.0 | 0.0 | 0.0 | 60 |
| | E-learning hours included: 0.0 | | | | | | |

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| Learning activity and number of study hours | Learning activity | Participation in didactic classes included in study plan | Participation in consultation hours | Self-study | SUM |
| | Number of study hours | 60 | 15.0 | 150.0 | 225 |
| Subject objectives | Students obtain competence in the range of using methods of mathematical analysis and knowledge how to solve simple problems that can be found in the field of engineering. | | | | |

| Learning outcomes | Course outcome | Subject outcome | Method of verification |
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| | [K6_U01] Apply knowledge and understanding of mathematics as well as sciences and engineering disciplines underlying civil engineering to solve engineering problems and issues. | Student lists geometrical applications of definite integrals. Student distinguishes between types of improper integrals. Student uses definite integral to solve geometrical tasks. Student computes partial derivatives and uses differential calculus to examine properties of the function of several variables. Student uses the basic operations on complex numbers. Student solves ordinary differential equations. Student computes multiple integrals and uses integral calculus to geometric and mechanics applications. Student computes the gradient of a scalar field, divergence and rotation of a vector field and a potential field. Student studies canvergence of number series. Student calculates the radius of convergence and the interval of convergence of a power series. Student uses power series in order to compute sums of number series. Student calculates the probability of random events. Student describes the basic types of distributions of random variable. Student gives the definition of basic notions of probability theory. | [SU1] Assessment of task fulfilment |
| | [K6_W01] Demonstrate knowledge and understanding of mathematics as well as sciences and engineering disciplines underlying civil engineering at a level necessary to achieve the other programme outcomes. | Student lists geometrical applications of definite integrals. Student distinguishes between types of improper integrals. Student uses definite integral to solve geometrical tasks. Student computes partial derivatives and uses differential calculus to examine properties of the function of several variables. Student uses the basic operations on complex numbers. Student solves ordinary differential equations. Student computes multiple integrals and uses integral calculus to geometric and mechanics applications. Student computes the gradient of a scalar field, divergence and rotation of a vector field and a potential field. Student studies canvergence of number series. Student calculates the radius of convergence and the interval of convergence of a power series. Student uses power series in order to compute sums of number series. Student calculates the probability of random events. Student describes the basic types of distributions of random variable. Student gives the definition of basic notions of probability theory. | [SW1] Assessment of factual knowledge |

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| Subject contents | **Definite integrals in Riemanns sense**: Newtona-Leibniza Thorem. Methods of evaluations of definite integrals. Applications of definite integrals. Improper integrals. Applications of improper integrals.Integration formulas, the substitution method of integration and integration by parts for definite integrals.Applications of integral calculus in computing areas of plane figures, lengths of arcs, volumes of solids of revolution.<br><br>**Functions of several variables:** Limit and continuity of a function of several variables. Partial derivatives. Total differential. Taylors formula. Maxima and minima of a function of several variables. Implicit functions.<br><br>**Complex numbers:** Algebraic, trigonometric, exponential form, operations, exponentiation (Moivre formula), finding roots of complex numbers. Operations on complex numbers.<br><br>**Ordinary differential equations:** First order differential equations. General and particular solution. The Cauchy initial value problem. Variables separable, linear, Bernoulli, exact differential equations. Second order linear differential equations with constant coefficients. Fundamental set of solution of the homogeneous linear differential equation. Non-homogeneous linear differential equations. Higher order linear differential equations with constant coefficients. Double and triple integrals. Applications of multiple integrals. Line integrals with applications.<br><br>**Elements of field theory and differential geometry:** Scalar and vector fields, the gradient of a scalar field, divergence and rotation of a vector field, a potential field. Line integrals with applications.<br><br>**Number series and function series:** Number series. Convergent and divergent series. Convergence tests of the number series. Power series. Radius and interval of convergence. Integration and differentiation of power series. Examples of applications - approximate calculation of integrals.<br><br>**Calculus of probability:** Discrete and continuous random variables, distribution function, expected value and variance of a random variable. Basic distribution of random variables. |
| Prerequisites and co-requisites | No requirements |

Assessment methods and criteria

| Subject passing criteria | Passing threshold | Percentage of the final grade |
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| Midterm colloquium | 50.0% | 40.0% |
| Written exam | 50.0% | 60.0% |

| Recommended reading | | |
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| | Basic literature | K. Jankowska, T. Jankowski, Funkcje wielu zmiennych. Całki wielokrotne. Geometria analityczna, PG, Gdańsk 2005. K. Jankowska, T. Jankowski, Zadania z matematyki wyższej, PG, Gdańsk 1999. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach I i II, Wydawnictwo Naukowe PWN, Warszawa 1998. E. Pluciński, Elementy probabilistyki, Wydawnictwo Naukowe PWN, Warszawa 1981. |
| | Supplementary literature | E. Mieloszyk, Liczby zespolone, PG, Gdańsk 2003. M. Gewert, Z. Skoczylas, Analiza matematyczna 2 Definicje, twierdzenia, wzory, Oficyna Wydawnicza GiS, Wrocław 2003. M. Gewert, Z. Skoczylas, Analiza matematyczna 2 Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2003. M. Gewert, Z. Skoczylas, Równania różniczkowe zwyczajne , Oficyna Wydawnicza GiS, Wrocław 2001. R. Leitner, Zarys matematyki wyższej I i II, Wydawnictwo Naukowo-Techniczne, Warszawa 2001. R. Leitner, W. Matuszewski, Z. Rojek, Zadania z matematyki wyższej I i II, Wydawnictwo Naukowo-Techniczne, Warszawa 1999. |
| | eResources addresses | Adresy na platformie eNauczanie: |

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| Example issues/ example questions/ tasks being completed | 1. Find the area between the two curves $y=e^x$ and $y=3-e^x$ from x=-2 to x=0.<br>2. Sketch the graph of the function $f(x,y)=x^2$.<br>3. Identify any local extrema of the function $f(x,y)=e^{x-y}(x^2-2y^2)$.<br>4. Find the absolute extrema of the function f(x,y)=xy-x(x+1)-y(y+1) on the set D={(x,y): $x^2+y^2$25, y3}.<br>5. Solve the equation $y''+6y'+9y=10\sin x$.<br>6. Find the divergence and rotation of the vector field $[2xe^{3y}+z^2, 3x^2e^{3y}+z, 2zx+y]$.<br>7. Find the distribution function, expected value and variance of a random variable X: P(-2)=0,1, P(-1)=0,5, P(0)=0,2, P(3)=0,1=P(5). |
| Work placement | Not applicable |