# GDAŃSK UNIVERSITY OF TECHNOLOGY

## Subject card

| Subject name and code | , PG_00041831 | | | | | |
|---|---|---|---|---|---|---|
| Field of study | Ocean Engineering, Ocean Engineering | | | | | |
| Date of commencement of studies | October 2020 | | Academic year of realisation of subject | | 2020/2021 | |
| 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 Leszek Ziemczonek | | | | |
| | Teachers | dr Leszek Ziemczonek | | | | |

| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|---|
| | Number of study hours | 30.0 | 40.0 | 0.0 | 0.0 | 0.0 | 70 |
| | E-learning hours included: 0.0 | | | | | | |
| | Adresy na platformie eNauczanie: WOiO - n.stac. - Matematyka 2 2020/21 (L.Ziemczonek) - Moodle ID: 6721 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6721 | | | | | | |

| 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 | 70 | 10.0 | 145.0 | 225 |

| Subject objectives | The aim of this subject is for the student to obtain the competence in using the basic methods of multivariable calculus, and to be able to use this knowledge to solve simple theoretical and practical problems that are found in the field of engineering. |
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| Learning outcomes | | Course outcome | Subject outcome | Method of verification |
|---|---|---|---|---|
| | | [K6_U02] can work individually and in a team, communicate through various techniques in professional environment and also record, analyse, and present the results of work, can estimate the time needed to complete a given task | Student defines the basic concepts of linear algebra. Student describes the methods of solving systems of linear equations. Student calculates the radius of convergence and determines the interval of convergence of a power series. Student applies the concept of functions of several variables to determine the extreme values of the function. Student explains the method of change of variables in double integral and triple integral. Student explains applications of double and triple integrals. Student distinguishes between line integrals and applies appropriate methods to calculate them. Student distinguishes between surface integrals and uses appropriate methods to calculate them. Student recognizes diferrent types of differential equations and selects the appropriate methods to solve them. Student solves linear differential equations of order n with constant coefficients using Laplace transform. Student recognizes the importance of skillful use of basic mathematical apparatus in terms of study in future. | [SU1] Assessment of task fulfilment |
| | | [K6_W01] has a basic knowledge in maths, including algebra, elements of logics, geometry, mathematical analysis, theory of probability necessary to describe and analyse the operation of machines and ocean-technology objects | Student defines the basic concepts of linear algebra. Student describes the methods of solving systems of linear equations. Student calculates the radius of convergence and determines the interval of convergence of a power series. Student applies the concept of functions of several variables to determine the extreme values of the function. Student explains the method of change of variables in double integral and triple integral. Student explains applications of double and triple integrals. Student distinguishes between line integrals and applies appropriate methods to calculate them. Student distinguishes between surface integrals and uses appropriate methods to calculate them. Student recognizes diferrent types of differential equations and selects the appropriate methods to solve them. Student solves linear differential equations of order n with constant coefficients using Laplace transform. Student recognizes the importance of skillful use of basic mathematical apparatus in terms of study in future. | [SW1] Assessment of factual knowledge |

| Subject contents | Elements of linear algebra: |
|---|---|
| | Matrices (definition, types of matrices, matrix operations), |
| | determinants (definition and properties), |
| | rank of a matrix, system of linear equations (Cramer"s rule, Kronecker-Capelli theorem, Gauss-Jordan elimination method). |
| | Number series and function series: |
| | Number series. Convergent and divergent series. |
| | Convergence tests for number series. |
| | Power series. Radius and interval of convergence. |
| | Taylor's and Maclaurin's series. Integration and differentiation of power series. |
| | Examples of applications - approximate calculation of integrals. |
| | Information on Fourier series |
| | Functions of two variables: |
| | Limit and continuity of a function of several variables. |
| | Partial derivatives. Total differential. |
| | Taylor's formula. |
| | Maxima and minima of a function of several variables. |
| | Implicit functions. |
| | Double integral: |
| | Definition, properties, interpretation; |
| | expressing the double integral as an iterated integral; |
| | integration by substitution (polar coordinates); |

applications of double integrals.

Triple integral:

Definition, properties, interpretation;

expressing the triple integral as an iterated integral;

integration by substitution (cylindrical coordinates and spherical coordinates);

application of triple integrals.

Line integrals:

Line integrals of the first kind - definition, properties and interpretation;

transforming the line integral to the corresponding definite integral.

Line integrals of the second kind (along oriented curves) - definition, properties and interpretation; transforming the line integral to the corresponding definite one; Green"s theorem; path independence.

Surface integrals:

Integrals of the first kind - definition, properties and interpretation; transforming the surface integral to the corresponding double integral.

Integrals of the second kind (surface-oriented) - definition, properties and interpretation; transforming the surface integral to the corresponding double integral; Gauss-Ostrogradski"s theorem; Stoke"s theorem.

Applications of surface integrals.

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. |
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| | Non-homogeneous linear differential equations. |
| | Higher order linear differential equations with constant coefficients. |
| | Laplace Transform: |
| | Definition, properties, inverse Laplace transform, solving differential equations using Laplace transform. |

| Prerequisites and co-requisites | Knowledge of subject: Mathematics I | | |
| --- | --- | --- | --- |

| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
| --- | --- | --- | --- |
| | Tests during the semester | 50.0% | 50.0% |
| | Written examination | 50.0% | 50.0% |

| Recommended reading | Basic literature | W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach 1, Wydawnictwo Naukowe PWN, Warszawa 2008 |
| --- | --- | --- |
| | | W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach 2, Wydawnictwo Naukowe PWN, Warszawa 2008 |
| | | M. Gewert, Z. Skoczylas, Analiza matematyczna 1. Definicje. Twierdzenia. Wzory. Oficyna Wydawnicza GIS, Wrocław 2008 |
| | | M. Gewert, Z. Skoczylas, Analiza matematyczna 2. Definicje. Twierdzenia. Wzory. Oficyna Wydawnicza GIS, Wrocław 2008 |
| | | M. Gewert, Z. Skoczylas, Analiza matematyczna 1. Przykłady i zadania. Oficyna Wydawnicza GIS, Wrocław 2008 |
| | | M. Gewert, Z. Skoczylas, Analiza matematyczna 2. Przykłady i zadania. Oficyna Wydawnicza GIS, Wrocław 2008 |
| | | T. Jurlewicz, Z. Skoczylas, Algebra liniowa 1. Definicje. Twierdzenia. Wzory. Oficyna Wydawnicza GIS, Wrocław 2006 |
| | | T. Jurlewicz, Z. Skoczylas, Algebra liniowa 1. Przykłady i zadania. Oficyna Wydawnicza GIS, Wrocław 2006 |
| | | T. Jurlewicz, Z. Skoczylas, Algebra liniowa 2. Definicje. Twierdzenia. Wzory. Oficyna Wydawnicza GIS, Wrocław 2006 |
| | | T. Jurlewicz, Z. Skoczylas, Algebra liniowa 2. Przykłady i zadania. Oficyna Wydawnicza GIS, Wrocław 2006 |
| | | K. Jankowska, T. Jankowski, Zbiór zadań z matematyki, Wydawnictwo PG, Gdańsk 2008 |
| | | K. Jankowska, T. Jankowski, Zadania z matematyki wyższej, Wydawnictwo PG, Gdańsk 2008 |
| | | K. Jankowska, T. Jankowski, Funkcje wielu zmiennych. Całki wielokrotne. Geometria analityczna, Wydawnictwo PG, Gdańsk 2008 |

| | Supplementary literature | W. Leksiński, I. Nabiałek, W. Żakowski, Matematyka. Definicje, twierdzenia, przykłady, zadania. WNT, Warszawa 2006 |
|---|---|---|
| | eResources addresses | WOiO - n.stac. - Matematyka 2 2020/21 (L.Ziemczonek) - Moodle ID: 6721<br>https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6721 |
| Example issues/ example questions/ tasks being completed | Not applicable | |
| Work placement | Not applicable | |