



Subject card

Subject name and code	Mathematics, PG_00042221						
Field of study	Civil Engineering						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2022/2023		
Education level	second-cycle studies	Subject group			Obligatory subject group in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			English		
Semester of study	1	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Railway Engineering -> Faculty of Civil and Environmental Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Anita Milewska				
	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						
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		5.0		60.0	125
Subject objectives	Equipping a student with a specialized mathematical apparatus supporting technical subjects.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_U03] can perform classic statical and dynamical analysis of rod structures stability (trusses, frames and ties), both statically determined and undetermined as well as surface structures (plates, membranes and shells)		The student combines knowledge in the field of mathematics with knowledge from other fields.		[SU2] Assessment of ability to analyse information		
	[K7_W01] has knowledge of higher mathematics, physics and chemistry, which is a base of subjects, such as construction theory and advanced material technology		The student knows the basic concepts in the field of - differential and integral calculus, partial differential equations, tensor calculus.		[SW1] Assessment of factual knowledge		
	[K7_U06] is able to choose proper tools (measuring, analytical or numerical) to solve engineering problems, to acquire, filtrate, proces and analyse data		The student determines the Fourier series of functions. The student uses Fourier series to solve partial differential equations. The student determines the inertia tensor. Student determines the eigenvalues and eigenvectors of linear operations and inertia tensors and interprets them. The student uses mathematical methods in the description of technical problems.		[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		

Subject contents	<p>Partial differential equations. Classifications of partial differential equations. Distinction of the second order partial differential equation. Elliptic, parabolic and hyperbolic equations. Applications of differential equations. Selected methods of solving partial differential equations. Elements of the variational account. Definition of a functional, definition of the extremum of a functional, basic lemma of a calculus of variations, Euler's equation, a precondition for the existence of an extremum of a functional, Jacobi's equation, Jacobi's condition. Conditions sufficient for the existence of the extreme of the functional. Tensor calculus. Matrices similar. Base in vector space. Matrix of transition from base to base. Linear operation and its matrix. Operation matrix when changing the base. Eigenvectors and eigenvectors of a linear operation and their determination. Tensor with a valence of 1 or 2. Tensor of inertia. Eigenvalues and eigenvectors of the inertia tensor. Invariants of changing the tensor base. Tensor quadric and its canonical form. Moments of inertia relative to a straight line. Strings and orthogonal series. Fourier series. Trigonometric Fourier series. Dirichlet conditions. Trigonometric Fourier series for even and odd functions. Application of the Fourier series for solving partial differential equations. Operator methods. Laplace transform. Basic properties of Laplace transform. Convolution of functions. Borel's theorem. Application of operator methods, including solving differential equations.</p>														
Prerequisites and co-requisites	<p>Knowledge in the field of mathematical analysis, algebra, vector calculus, ordinary differential equations.</p>														
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="451 730 794 763">Subject passing criteria</th> <th data-bbox="794 730 1137 763">Passing threshold</th> <th data-bbox="1137 730 1487 763">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 763 794 797">Colloquium No. 1</td> <td data-bbox="794 763 1137 797">55.0%</td> <td data-bbox="1137 763 1487 797">20.0%</td> </tr> <tr> <td data-bbox="451 797 794 831">Colloquium No. 2</td> <td data-bbox="794 797 1137 831">55.0%</td> <td data-bbox="1137 797 1487 831">20.0%</td> </tr> <tr> <td data-bbox="451 831 794 860">Exam</td> <td data-bbox="794 831 1137 860">55.0%</td> <td data-bbox="1137 831 1487 860">60.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Colloquium No. 1	55.0%	20.0%	Colloquium No. 2	55.0%	20.0%	Exam	55.0%	60.0%
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Recommended reading	<p>Basic literature</p>	<p>H. Bateman: Tables of integral Transforms. McGraw-Hill Book Company.</p> <p>L. C. Evans: Partial Differential Equations AMS.</p> <p>I. M. Gelfand, S. W. Fomin: Rachunek wariacyjny. PWN.</p> <p>M.I.Krasnov, G.I.Makarenko, A.I. Kiselev: Problems and exercises in the calculus of variations. Mir Publishers.</p> <p>A. J. McConnel: Application of tensor analysis. Dover Publications Inc.</p>													
	<p>Supplementary literature</p>	<p>E. Mieloszyk: Nielasyczny rachunek operatorów w zastosowaniu do uogólnionych układów dynamicznych. Wyd. PAN.</p> <p>W. T. Thomson: Theory of Vibrations. Unwin Hyman.</p>													
	<p>eResources addresses</p>	<p>Adresy na platformie eNauczenie:</p>													
Example issues/ example questions/ tasks being completed	<p>Definition of an orthogonal matrix. Determine the sine Fourier series corresponding to the function. Definition of eigenvalues and eigenvectors of matrix A. Weierstrass criterion. Theorem on the differentiation of a series.</p>														
Work placement	<p>Not applicable</p>														