Type and description       Elective Course         EC15 credit       1         Course name       Integrals of vector functions         Course name in Polish       Calki funkcji vektorowych         EC15 credit       8 PRK         Course name in Polish       8 PRK         Course coordinator       Marek Balcerzak         Course duration       8 PRK         Course duration       Marek Balcerzak         Course duration       Marek Balcerzak         Course duration       0       0       15       0       0       15         Delivery methods and strong mesure duration       0.00       15       0.00       15       0.00       15         Course objective       0.00       0.00       15       0.00       15       0.00       15         Course objective       1       Acquiring knowledge about the Riemann integral for vector functions on [a,b]       2. Acquiring knowledge about the Bochner integral and the Petitis integrals for vector functions.         Learning outcomes       Having completed the course student can:       1       1. Describe weak and strong messurability of vector functions with examples - effects W4, U4, K1       2. Describe weak and strong messurability of vector functions - effects W4, K1       3. Use the Bochner integral and its properies - effects U4, K1       3. Use the Bochner inte	Course code								
Course name         Integrals of vector functions           Course name in Polish         Calki funkcji wektorowych           Language of instruction         English           Course name in Polish         SPRK           Course coordinator         Marek Balcerzak           Course instructors         Marek Balcerzak           Delivery methods and course instructors         Marek Balcerzak           Course duration         Contect hours         0         0         15         0         0         15           Delivery methods and course objective         Contect hours         0         0         15         0         0         15           Course objective         Course objective:         1         Acquiring knowledge about the Riemann integral for vector functions on [a,b]         2         Acquiring knowledge about the Bochner integral and the Petis integrals for vector functions.           Learning outcomes         Having completed the course student can:         1         Describe weak and strong measurability of vector functions effects W4, U4, K1           2         Describe weak and strong measurability of vector functions effects W4, U4, K1         2         Describe weak and strong measurability of vector functions with examples - effects W4, U4, K1           2         Describe weak and strong measurability of vector functions - effects W4, K1         3         Use the	Type and description	Elective Course							
Course name in Polish         Calki funkcji wektorowych           Language of instruction         English           Course level         8 PRK           Course instructors         Marek Balcerzak           Delivery methods and course duration         Image: Course duration           Course duration         Marek Balcerzak           Course instructors         Marek Balcerzak           Delivery methods and course duration         0           Course objective         0.00           Course objective         0.00           Course objective         0.00           Course objective         1. Acquiring knowledge about the Riemann integral for vector functions on [a,b]           2. Acquiring knowledge about weak and strong measurability of vector functions defined on a measure space.           3. Acquiring basic knowledge about weak and strong measurability of vector functions defined on a measure space.           3. Acquiring basic knowledge about the Bochner integral and the Petis integrals for vector functions.           Learning outcomes         Having completed the course student can:           1. Describe weak and strong measurability of vector functions effects W4, K1           3. Use the Bochner integral and its properties - effects U4, K1           3. Use the Bochner integral and its properties - effects U4, K1           Assessement methods         W4 - oral exam	ECTS credit	1							
Language of instruction         English           Course level         8 PRK           Course instructors         Marek Balcerzak           Delivery methods and course instructors         Image: Course instructors           Delivery methods and course instructors         Image: Course instructors           Course instructors         Marek Balcerzak           Delivery methods and course objective:         Image: Course objective:           Course objective         0.00           Course objective:         1. Acquiring knowledge about the Riemann integral for vector functions on [a,b]           2. Acquiring knowledge about the Bochner integral and the Pettis integrals for vector functions.           Learning outcomes         Having completed the course student can:           1. Describe definition of the Riemann integral for vector functions with examples - effects W4, U4, K1           2. Describe weak and strong measurability of vector functions with examples - effects W4, U4, K1           2. Describe weak and strong measurability of vector functions - effects W4, U4, K1           3. Use the Bochner integral and its properties - effects U4, K1           Assessment methods         W4 - oral exam           V4, V4 - written project         The final grade           Exam - 50%         Presentation - 20%           Preject evaluation - 30%         - 30%	Course name	Integrals of vector functions							
Course level       8 PRK         Course coordinator       Marek Balcerzak         Course instructors       Marek Balcerzak         Delivery methods       and course duration       Image: Context hours       0       0       15       0       0       15         Delivery methods       and course duration       Image: Context hours       0       0       15       0       0       15       0       0       15         Course objective       Course objective:       Course objective:       Course objective:       0.00       0       15       0       0.00       0       15         Course objective       Course objective:       Course objective:       1       Acquiring knowledge about the Riemann integral for vector functions on [a,b]       2. Acquiring knowledge about the Bochner integral and the Pettis integrals for vector functions.         Learning outcomes       Having completed the course student can: 1. Describe definition of the Riemann integral for vector functions with examples - effects W4, U4, K1 2. Describe weak and strong measurability of vector functions with examples - effects W4, U4, K1 2. Describe weak and strong measurability of vector functions - effects W4, K1 3. Use the Bochner integral and its properties - effects U4, K1 2. Describe weak and strong measurability of vector functions - effects W4, K1 3. Use the Bochner integral and its properties - effects U4, K1 4. Coral exam U4, K1 - project seminar presentation W4, U4 - written project The final grade Exam -	Course name in Polish	Całki funkcji wektorowych							
Course coordinator       Marek Balcerzak         Course instructors       Marek Balcerzak         Delivery methods and course duration       Image: Course duration       Course instructors       Marek Balcerzak         Delivery methods course duration       and course duration       Image: Course duration       Course instructors       One of the sening income duration       Course objective         Course objective       Course objective:       No       No<	Language of instruction	English							
Course instructors       Marek Balcerzak         Delivery methods and course duration       Image: Course dur	Course level	8 PRK							
Delivery methods course duration       and course duration       Lecture       Tutorials       Laboratory       Project       Seminar       Other       Total of bors hours h	Course coordinator	Marek Balcerzak							
course duration         Lecture         Tutorials         Laboratory         Project         Seminar         Other         Reaching during semister           Contect hours         0         0         15         0         0         15           E-learning         No	Course instructors	Marek Balcerzak							
Eterming       No       Ro	-		Lecture	Tutorials	Laboratory	Project	Seminar	Other	teaching hours during
Assessment criteria (weightage)       0.00       0.00         Course objective       Course objective: 1. Acquiring knowledge about the Riemann integral for vector functions on [a,b]       2. Acquiring knowledge about weak and strong measurability of vector functions defined on a measure space.         3. Acquiring basic knowledge about the Bochner integral and the Pettis integrals for vector functions.         Learning outcomes       Having completed the course student can: 1. Describe definition of the Riemann integral for vector functions with examples - effects W4, U4, K1         2. Describe weak and strong measurability of vector functions - effects W4, K1         3. Use the Bochner integral and its properties - effects U4, K1         Assessment methods       W4 - oral exam U4, K1 - project seminar presentation W4, U4 - written project The final grade Exam - 50% Presentation - 20% Project evaluation - 30%		Contact hours		0	0	15	0	0	
course objective       0.00       0.00       0.00         Course objective       Course objective:       1. Acquiring knowledge about the Riemann integral for vector functions on [a,b]       2. Acquiring knowledge about weak and strong measurability of vector functions defined on a measure space.         3. Acquiring basic knowledge about the Bochner integral and the Pettis integrals for vector functions.       Having completed the course student can:         1. Describe definition of the Riemann integral for vector functions with examples - effects W4, U4, K1       Describe weak and strong measurability of vector functions with examples - effects W4, U4, K1         2. Describe weak and strong measurability of vector functions - effects W4, K1       Use the Bochner integral and its properties - effects U4, K1         Assessment methods       W4 - oral exam       U4, K1 - project seminar presentation         W4, U4 - written project       The final grade       Exam - 50%         Presentation - 20%       Project evaluation - 30%       U		E-learning	No	No	No	No	No	No	
1. Acquiring knowledge about the Riemann integral for vector functions on [a,b]2. Acquiring knowledge about weak and strong measurability of vector functions defined on a measure space.3. Acquiring basic knowledge about the Bochner integral and the Pettis integrals for vector functions.Learning outcomesHaving completed the course student can: 1. Describe definition of the Riemann integral for vector functions with examples - effects W4, U4, K1 2. Describe weak and strong measurability of vector functions - effects W4, K1 3. Use the Bochner integral and its properties - effects U4, K1Assessment methodsW4 - oral exam U4, K1 - project seminar presentation W4, U4 - written project The final grade Exam - 50% Presentation - 20% Project evaluation - 30%		criteria	0,00					0,00	
2. Acquiring knowledge about weak and strong measurability of vector functions defined on a measure space.         3. Acquiring basic knowledge about the Bochner integral and the Pettis integrals for vector functions.         Learning outcomes       Having completed the course student can: <ol> <li>Describe definition of the Riemann integral for vector functions with examples - effects W4, U4, K1</li> <li>Describe weak and strong measurability of vector functions - effects W4, K1</li> <li>Use the Bochner integral and its properties - effects U4, K1</li> </ol> Assessment methods       W4 - oral exam         U4, K1 - project seminar presentation       W4, U4 - written project         The final grade       Exam - 50%         Presentation - 20%       Project evaluation - 30%	Course objective								
measure space.         3. Acquiring basic knowledge about the Bochner integral and the Pettis integrals for vector functions.         Learning outcomes       Having completed the course student can:         1. Describe definition of the Riemann integral for vector functions with examples - effects W4, U4, K1         2. Describe weak and strong measurability of vector functions - effects W4, K1         3. Use the Bochner integral and its properties - effects U4, K1         3. Use the Bochner integral and its properties - effects U4, K1         4. V4 - oral exam         U4, K1 - project seminar presentation         W4, U4 - written project         The final grade         Exam - 50%         Presentation - 20%         Project evaluation - 30%		2. Acquiring knowledge about weak and strong measurability of vector functions defined on a							
Learning outcomes       Having completed the course student can:         1. Describe definition of the Riemann integral for vector functions with examples - effects W4, U4, K1         2. Describe weak and strong measurability of vector functions - effects W4, K1         3. Use the Bochner integral and its properties - effects U4, K1         Assessment methods       W4 - oral exam         U4, K1 - project seminar presentation         W4, U4 - written project         The final grade         Exam - 50%         Presentation - 20%         Project evaluation - 30%									
1. Describe definition of the Riemann integral for vector functions with examples - effects W4, U4, K12. Describe weak and strong measurability of vector functions - effects W4, K13. Use the Bochner integral and its properties - effects U4, K1Assessment methodsW4 - oral examU4, K1 - project seminar presentationW4, U4 - written projectThe final gradeExam - 50%Presentation - 20%Project evaluation - 30%		3. Acquiring basic knowledge about the Bochner integral and the Pettis integrals for vector functions.							
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3. Use the Bochner integral and its properties - effects U4, K1         Assessment methods       W4 - oral exam         U4, K1 - project seminar presentation         W4, U4 - written project         The final grade         Exam - 50%         Presentation - 20%         Project evaluation - 30%		1. Describe definition of the Riemann integral for vector functions with examples - effects W4, U4, K1							
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U4, K1 - project seminar presentation W4, U4 - written project The final grade Exam - 50% Presentation - 20% Project evaluation - 30%		3. Use the Bochner integral and its properties - effects U4, K1							
W4, U4 - written project The final grade Exam - 50% Presentation - 20% Project evaluation - 30%	Assessment methods	W4 - oral exam							
The final grade Exam - 50% Presentation - 20% Project evaluation - 30%		U4, K1 - project seminar presentation							
Exam - 50% Presentation - 20% Project evaluation - 30%		W4, U4 - written project							
Presentation - 20% Project evaluation - 30%		The final grade							
Project evaluation - 30%		Exam - 50%							
		Presentation - 20%							
Prerequisites Theory of the Riemann and the Lebesgue integrals for real functions		Project evaluation - 30%							
	Prerequisites	Theory of the Riemann and the Lebesgue integrals for real functions							
Course content with LECTURE	Course content with	LECTURE							

delivery methods	1. Riemann integral for vector functions on [a,b], equivalent definitions and properties.				
	2. The Lebesgue property of Banach spaces, examples.				
	3. Weak and strong measurability of vector functions on a measure space. The Pettis theorem.				
	4. Bochner integral and its properties. Information on Dunford and Pettis integrals.				
	PROJECT				
	1.Examples of integration in the Riemann sense for vector functions				
	2.Selected properties of the Bochner integral.				
Basic reference materials	1. R. A. Gordon, Riemann integration in Banach spaces, Rocky Mountain J. Math. 21 (1991), 923 949.				
	2. J. Diestel, J. J. Uhl, Vector measures, AMS 1977.				
Other reference materials					
Average student workload outside classroom	10 h				
Comments					
Last update	11.05.2023				