Course description

Course unit title	Course unit code
Risk management	

Lecturer(s)	Department where the course unit is delivered
assoc. prof. Martynas Manstavičius	Faculty of Mathematics and Informatics, Vilnius University, Naugarduko 24, LT-03225 Vilnius, Lithuania

Cycle	Type of course unit
Second	compulsory

Mode of delivery	Semester or period when the course is delivered	Language of instruction
Face-to-face	Second (spring) semester	Lithuanian, English

Prerequisites and corequisites	
Prerequisites: measure-theoretic probability theory	**Corequisites (if any) :**

Number of ECTS credits	Student's workload	Contact hours	Individual work hours
5	125	32	93

Course objectives: programme competences to be developed		
This course is designed to provide an axiomatic foundation to risk measures used in applications. Concepts, ideas and many theoretical results that are scattered throughout many scientific papers will be studied. Ability to search for and critically analyze relevant material, as well as present to peers, will be fostered. **(Programme competences fostered: 3.2, 3.3, 4.1, 4.2, 5.2, 6.3)**		
Learning objectives	**Learning methods**	**Assesment methods**
- Knowledge, understanding and ability to formulate the axioms of coherent risk measures, their generalizations, and sets of acceptable risks	Lectures, discussions, individual study of supplementary literature	Testing (open/closed book)
- Knowledge of at least two characterizations of coherent risk measures		
- Knowledge of the usage examples of coherent risk measures		
- Demonstrate knowledge of the subject matter, terminology, methods and conventions covered in this course		
- Demonstrate ability to solve problems involving risk measures		

Course content: breakdown of the course	Contact hours					Individual work hours and assignments	
	Lectures	Consultations	Seminars	Recitation hours	**Total contact hours**	**Individual work hours**	Assignments
1. Axioms for sets of acceptable risks and examples	**2**				**2**	**4**	Read through [1, Sect. 1-2], study recommended literature
2. Axioms for risk measures; their correspondence with sets of acceptable positions; first examples	**4**				**4**	**9**	Read through [1, Sect. 1-2], study recommended literature
3. First characterization of coherent risk measures; practical implementation	**4**				**4**	**9**	Read through [1, Sect. 3], study recommended literature
4. Second characterization of coherent risk measures; practical implementation	**4**				**4**	**9**	Read through [1, Sect. 4], study recommended literature
5. Popular risk measures: VaR, TCE, WCE, ES	**8**				**8**	**16**	Read through [1, Sect. 5], study recommended literature [4]
6. Generalizations of coherent risk measures (spectral, convex and other types of measures)	**8**				**8**	**16**	Read through [2, 3], study recommended literature [5]
7. Midterm (preparation and writing)	**2**				**2**	**10**	Review theory and problem solutions
8. Final exam (preparation and writing)						**20**	Review theory and problem solutions
Total	**32**				**32**	**93**	

Assesment strategy	Weight	Time of assesment	Criteria
Midterm This 2 hr midterm exam contains theoretical (closed-book) and problem solving (open book) parts. Points are awarded for each successfully answered question/problem. The midterm contains material from topics I through III.	**50%**	**During classes (approx. 11-12th week)**	**10 points** – between 90% and 100% of available points on a test **9 points** – between 80% and 89.99% of available points on a test **8 points** – between 70% and 79.99% of available points on a test **7 points** – between 60% and 69.99% of available points on a test **6 points** – between 50% and 59.99% of available points on a test **5 points** – between 40% and 49.99% of available points on a test **1-4 points** – less than 40% of available points on a test
Final exam The final 2 hr long written exam covers material from topics I through III. It contains theoretical closed-book	**50%**	**During exam period**	**10 points** – A student shows excellent knowledge of the course material, is able to analyze and generalize it, understands and correctly uses concepts, knows the main results of discrete time mathematical finance. He/she has collected between 90% and 100% of the available points. **8-9 points** – A student shows good/very good knowledge of

and practical open-book parts. Points are awarded for each successfully answered question/problem.			the course material, is able to systematize and generalize it, understands used concepts, knows the majority of results of discrete time mathematical finance. 9 points are awarded for collecting between 80% and 89.99% of the available points; 8 points are awarded for collecting between 70% and 79.99% of the available points. **6-7 points** – A student understands the main concepts of the course and knows most of the main results of discrete time financial mathematics. 7 points are awarded for collecting between 60% and 69.99% of the available points; 6 points are awarded for collecting between 50% and 59.99% of the available points. **5 points –** A student shows skin-deep understanding of the concepts of discrete time financial mathematics. He/she has collected between 40% and 49.99% of available points **4-1 points** – A student does not know the studied material and inappropriately uses the terms and concepts of the course. Has collected less than 40% of the available points.

Author	**Publication year**	**Title**	**Volume and/or number of publication**	**Publication place and publisher**
Required reading				
1. P. Artzner, F. Delbaen, J.-M. Eber, and D. Heath	1999	Coherent measures of risk	Math. Finance **9**(3), pp 203-228	Willey Periodicals, Inc. Available for free at http://onlinelibrary.wiley.com/doi/10.1111/1467-9965.00068/pdf (last checked 2020-01-29)
2. C. Acerbi	2002	Spectral measures of risk: A coherent representation of subjective risk aversion	Journal of Banking & Finance **26,** pp. 1505-1518	Elsevier
3. H. Föllmer and A. Schied	2002	Convex measures of risk and trading constraints	Finance and Stochastics **6**, pp. 429-447	Springer
4. C. Acerbi, D. Tasche	2002	On the coherence of expected shortfall	Journal of Banking & Finance, **26**(7), pp. 1487-1503	Elsevier
Recommended reading				
5. F. Delbaen	2000	Coherent risk measures on general probability spaces		Preprint available at http://www.math.ethz.ch/~delbaen/ (last checked on 2012-03-05)