Subject code	ECTS credits
MAT6007	6

Course title in Lithuanian

RIZIKOS IR PATIKIMUMO ANALIZĖ

Course title in English

RISK AND RELIABILITY ANALYSIS

Short course annotation in Lithuanian (up to 500 characters)

Įgyjamos teorinės ir praktinės rizikos ir patikimumo analizės žinios. Kursas apima kiekybinį ir kokybinį rizikos apibrėžimus, rizikos vertinimo procedūrą, pavojų identifikavimo metodus, gedimų ir įvykių medžių analizes, sistemos patikimumą, pagrindinius tikimybinius skirstinius, naudojamus patikimumo analizėje, sistemų rezervavimą, sistemos komponentų svarbos nustatymą, gedimų duomenų analizę, Monte-Karlo metodą, jautrumo ir neapibrėžtumo analizę, Bajeso metodo taikymą patikimumo analizėje.

Short course annotation in English (up to 500 characters)

Acquired theoretical and practical knowledge on risk and reliability analysis: qualitative and quantitative definitions of risk, risk analysis procedure, hazard identification techniques, fault and event tree analyses, system reliability, main probabilistic distributions in reliability theory, system redundancy, component importance, failure data analysis, Monte-Carlo simulation, sensitivity and uncertainty analysis, Bayesian inference in reliability analysis.

Prerequisites for entering the course

Mathematical Analysis, Probability Theory, Mathematical Statistics.

Course aim

Course aim is to provide deeper knowledge of risk and reliability analysis.

Links between course outcomes, criteria of learning achievement evaluation, study methods and methods of learning achievement assessment

No	Course outcomes	Criteria of learning achievement evaluation	Study methods	Methods of learning achievement assessment
1	Knowledge and understanding of main concepts of risk analysis and risk assessment procedure.	Student knows the definitions of main concepts of systems risk analysis.	Lectures, practical works, individual work, consulting	Mid-term exam, assessment of homework
2	Provide knowledge on hazard identification techniques.	Student demonstrates the ability to identify hazards in a particular case using hazard identification techniques.	Lectures, practical works, individual work, consulting	Mid-term exam, assessment of homework
3	Provide knowledge on a fault and event tree analyses	Student demonstrates the ability to construct a fault and event trees in a particular case and perform their analysis.	Lectures, practical works, individual work, consulting	Mid-term exam, assessment of homework
4	Knowledge and understanding of system reliability analysis.	Student demonstrates the ability to calculate reliability characteristics of a particular system based on failure data analysis, taking into account uncertainties of initial data.	Lectures, practical works, individual work, consulting	Final exam
5	Ability to work in a group for a common case study analysis.	Student demonstrates the ability to formulate task, present solution process, justify received results, present research work.	Individual and team work, self-study of literature, discussions, consulting	Assessment of practical work

Links between study programme outcomes and course outcomes

Study programme outcomes	Running number of course outcome				
	1	**2**	**3**	**4**	**5**
1. Deepen and expand general knowledge of mathematics and apply it in a new non-standard environment	+	+	+	+	+
3. Broaden and apply the knowledge of reliability analysis and statistical methods for data analysis	+	+	+	+	
5. Develop mathematical models integrating the knowledge from various fields and different mathematical modelling techniques, and analyse the modelling results assessing the model adequacy and accuracy			+	+	+
7. Analyse, understand and use mathematical methods		+	+	+	
8. Transform heuristic arguments into mathematical language; prove the propositions by using known patterns		+	+	+	+
10. Work both independently and in an interdisciplinary team, generate ideas, integrate knowledge and skills					+
13. Take moral responsibility for the results of work					+

Content

No	Content (topics)
1.	Basic concepts of risk analysis: qualitative and quantitative definitions of risk; risk analysis procedure.
2.	Hazard identification techniques: Failure mode, effect and criticality analysis (FMECA), Hazard and operability analysis (HAZOP).
3.	Fault tree analysis.
4.	Event tree analysis.
5.	Reliability characteristics.
6.	Series, parallel and r-out-of-n systems.
7.	Main probabilistic distributions in reliability theory.
8.	System redundancy.
9.	Component importance.
10.	Failure data analysis
11.	Monte-Carlo simulation.
12.	Sensitivity and uncertainty analysis.
13.	Bayesian inference in reliability analysis

Distribution of workload for students (contact and independent work hours)

Lectures	45 hours
Practical work	**15 hours**
Individual students work	**100 hours**
Total:	**160 hours**

Structure of cumulative score and value of its constituent parts

Final written exam (50%), mid-term written exam (35%), assessment of homework (15%).

Recommended reference materials

No	Publication year	Authors of publication and title	Publishing house	Number of copies in		
				University library	*Self study rooms*	*Other libraries*
Basic materials						
1	2006	Augutis J., Ušpuras E. Technologijų rizika (Technology Risk)	Aušra		40	

2	1996	Lewis E.E., Introduction to Reliability Engineering (2nd edition)	John Wiley & Sons Inc.		1	
3	2004	Rausand M. System Reliability Theory - Models and Statistical Methods and applications	John Wiley & Sons Inc.			Google books
4	2007	Zio E. An introduction to the basics of reliability and risk analysis	Singapure by World Scientific Papers		1	Google books
5	2001	Bedford T., Cooke R. Probabilistic Risk Analysis: Foundations and Methods	Cambridge University Press		1	
6	2003	Aven T. Foundations of Risk Analysis	John Wiley & Sons Inc.		1	
		Supplementary materials				
1	2004	Haimes Y.Y. Risk modeling, Assessment, and Management	John Wiley & Sons Inc.			
2	2003	Cacusi D.G. Sensitivity and Uncertainty Analysis Theory	Chapman & Hall/CRC			
3	2002	Kalbfleisch J.D., Prentice R.L. The Statistical Analysis of Failure Time Data.	John Wiley & Sons, Inc.			

Course programme designed by

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