RTU Course "Experimental design and statistical treatment of experimental data"

31000 Faculty of Civil and Mechanical Engineering

General data

Code	BM0249
Course title	Experimental design and statistical treatment of experimental data
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Mārtiņš Kleinhofs
Academic staff	Vitālijs Pavelko
Volume of the course: parts and credits points	1 part, 8.0 credits
Language of instruction	LV, EN
Annotation	The study module envisages an in-depth understanding of the planning of scientific experiments from the evaluation of initiation parameters, moment methods, maximum reliability methods, evaluation distribution functions to the development of a general linear model. Study module the task is to develop students' competence in conducting scientific experiments, to develop the ability to analyze the obtained experimental results.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to master the basic concepts and methods of scientific experiment planning, to acquire practical skills in conducting experiments and conducting them. The task of the study module is to understand and be able to use, to process the obtained experimental results by applying mathematical statistical methods to solve the aircraft fatigue problem.
Structure and tasks of independent studies	In-depth study of textbooks, papers and information from the internet. Modelling of random variables and results of data processing using EXCEL program in computer classroom of Aviation Institue of RTU.
Recommended literature	1. Paramonovs Ju . M. Transporta līdzekļu slodzes, resurss un drošums. // RTU, Av. Institūts, 2002. - 108 lpp. 2. Paramonov Yu., Kuznetsov A. Using of p-set function for airframe inspection program development // International Journal "Communication of Dependability and Quality Management ", Volume 9, Number 1, 2006, pp. 51-55. 3. Парамонов Ю. М. Методы математической статистики и задач, связанных с оценкой и обеспечением усталостной долговечности авиационных конструкций. - Рига: РКИИГА, 1991, - 248 с. 4. Paramonov Yu.M., Aircraft fatigue problem solutuion by use of modern mathematical statistics methods. // AVIATION, #6 Vilnius: Technika . 2002, – pp. 83-96. 5. Eiropas Komisdijas Regulas (EK) Nr.1321/2014 (2014. g. 26. novembris) materiāli 6. Trott P. . Innovation management and new product development. Financial Times/Prentice Hall, 2012, 620 p. 7. Caune J. Stratēģiskā vadīšana, R.: Lidojošā zivs 2009., 236 lpp. 8. Papildus literatūra atbilstoši studējošajiem nepieciešamo zināšanu un prasmju attīstībai.
Course prerequisites	Mathematics, theory of probability and mathematics statistics.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Random variable sample.	2	6	0	0
The method of sections. Application of the distribution function with location and scale parameters (DLSP).	2	6	0	0
The method of moments. Application for the DLSP.	2	6	0	0
Sufficient statistics. Maximum-likelihood method (MLM). Censored data.	4	6	0	0
Least square method.	4	6	0	0
Estimation of location and scale parameters based on linear combination of order statistics.	2	6	0	0
Unbiased estimation (UE). Example of UE of reliability for exponential distribution.	2	6	0	0
Bayes solutions. A prior probability and a posterior probability. Loss function.	4	8	0	0
Rao-Cramer-Freshe inequality. Information matrix.	4	8	0	0
MLM estimate distribution. Information matrix.	2	8	0	0
Statistical hypothesis testing. Two types of errors. The level of significance of the test. Power of test.	4	8	0	0
Tests of the normal distribution mean. Connection with confidence interval.	4	8	0	0
P-bound for random variable.	2	8	0	0
Required sample size for required power of test. Application for normal distribution.	4	8	0	0
Parameter comparison. Hypothesis testing concerning means of two normal distributions.	2	8	0	0
Distribution-free or nonparametric test of equality of the two population means.	4	6	0	0

One-way analysis of variance.	4	8	0	0
Two-factor analysis of variance.	4	8	0	0
Regression analysis.	4	8	0	0
General linear model.	4	8	0	0
Total:	64	144	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
A student understands mathematical statistical methods for distribution function parameter estimation.	Test.
A student understands the mathematical methods for statistical hypothesis testing.	Test.
A student is able to make one-way analysis of variance.	Laboratory work, test.
A student is able to make two-factor analysis of variance.	Laboratory work, test.
A student is able to make regression analysis.	Laboratory work, test.
A student is able to make data analysis using general linear model.	Laboratory work, test.
A student understands and is able to use mathematical statistical methods for airplane reliability problem solution.	Exam.

Evaluation criteria of study results

Criterion	%
Laboratory works	40
Presentations	40
Exam	20
Total:	100

Study subject structure

Part	CP	Hours			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	8.0	32.0	0.0	32.0		*	