RTU Course "Markov Processes and Preventive Maintenance Models"

15E03 Lidaparātu teorijas un konstrukcijas katedra

General data

Code	TAK513
Course title	Markov Processes and Preventive Maintenance Models
Course status in the programme	Compulsory/Courses of Limited Choice; Courses of Free Choice
Course level	Post-graduate Studies
Course type	Academic
Field of study	Transport
Responsible instructor	Paramonovs Jurijs
Volume of the course: parts and credits points	1 part, 2.0 Credit Points, 3.0 ECTS credits
Language of instruction	LV, EN
Possibility of distance learning	Not planned
Maximum auditorium capacity	30
Maximum number of students per semester	30
Abstract	Introduction to Markov chains theory. Using of absorbing Markov chains theory for modeling static strength and fatigue life of material used for aircraft structure. Theory of stationary Markov chain with rewards and preventive maintenance planning.
Goals and objectives of the course in terms of competences and skills	To get knowledge about Markov process theory and its applications to specific airplane reliability analyses. To know how to use absorbing Markov chains in order to get distribution function of fatigue life of airplane structures details, mean and variance of airplane fatigue life. To know how to use the theory of stationary Markov chains in order to get stationary probability distribution. To be able to develop preventive maintenance planning using theory of Markov chain with rewards.
Structure and tasks of independent studies	Not planned.
Recommended literature	1. Paramonovs Ju. M. Transporta līdzekļu slodzes, resurss un drošums. // RTU, Av. Institūts, 2002. - 108 lpp. 2. Gertsbakh. I. Reliability theory. With application to preventive maintenance.// Springer-Verlag. Berlin Heidelberg. New York, 2000. – 220 p. 3. Haggstrom O. Finite Markov chains and algorithmic applications. London Mathematical Society. Student Texts 52. Cambridge university press, 2002. 4. Norris J.R. Markov Chains. Cambridge university press, 1997. 5. Gertsbakh I.B. Models of preventive maintenance. //Amst-NY- Oxf.: North-Hol. Publ., 1997. 6. Carkova V., Kalniņa D. Gadījuma procesi.//Latv. valst univer., Rīga, 1981. 7. Кемени Дж., Снелл Дж. Конечные цепи Маркова. //М.: Наука, 1970. 8. Ховард Р.А. Динамическое программирование и марковские процессы. // М.: Сов. радио, 1964. 9. Андронов А.М., Севастьянов Н.П. Вероятностные процессы в автоматизированных системах управления гражданской авиации. - РИГА: РКИИГА, 1989. 10. Triverdi K.Sh. Probability and statistics with reliability, queuing and computer science applications. USA: Prentice – Hall International, 1982.
Course prerequisites	Mathematics, theory of probability and mathematical statistics, strength of materials, aerodynamics.

Course outline

Theme	Hours
Markov chains classification.	2
Homogeneous finite Markov chains. Limiting probabilities.	2
Absorbing Markov chains.	4
Fundamental matrix and its applications.	6
Distribution of time between state changes. Distribution of time to absorption.	2
Z-transformation. Markov processes with rewards.	6
Inspection and preventive maintenance planning.	6
Continuous time Markov processes.	4

Learning outcomes and assessment

Learning outcomes	Assessment methods
To extend student's knowledge about Markov process theory and specific airplane reliability analysis methods.	Test.
To understand preventive airplane maintenance model analysis methods.	Laboratory work, test.
To be able to use specific methods of Markov process theory.	Exam.

Study subject structure

Part	CP	ECTS	Hours per Week			Tests			Tests (free choice)		
			Lectures	Practical	Lab.	Test	Exam	Work	Test	Exam	Work
1.	2.0	3.0	1.5	0.0	0.5		*			*	