Stochasic Processes in System Dynamics I.

1. Subject name	Stochasic Processes in System Dynamics I.				
2. Subject name in Hungarian	Sztochasztikus folyamatok a rendszerdinamikában I.				
3. Code	**BMEKOVJD009**	4. Evaluation type	**exam grade**	5. Credits	**4**
6. Weekly contact hours	**2 (0) Lecture**	**0 (0) Practice**	**0 (0) Lab**		
7. Curriculum	**PhD Programme**	8. Role	**Basic course**		
9. Working hours for fulfilling the requirements of the subject					**120**
Contact hours	28	Preparation for seminars	30	Homework	0
Reading written materials	30	Midterm preparation	0	Exam preparation	32
10. Department	**Department of Aeronautics and Naval Architectures**				
11. Responsible lecturer	Dr. Zobory István				
12. Lecturers	Dr. Zobory István				
13. Prerequisites	**recommended: BMEKOVJD001 - Analitical Methots in System Technique I.**				

14. Description of lectures

Stochastic excitation of a deterministic dynamical system model. Deterministic excitation of a stochastic dynamical system model: the output as a stochastic process. Horisontal and vertical characterisation of a stochastic process. The probability field. Operations among events. The relative frequency. The Lebesgue-type probability field. Roperties of the probability measure. Cpnditional probability. Conditional probability field. Conditional probability with respect to a zero probabilty condition event. Independence of events. Pair-wise and complete independence of the elements of event sequences. Complete set of events. The theorem of complete probability. The Bayes theorem. The mapping of the set of elementary events on a linear space. The linear space of random variables. Norm of linear spaces. Completeness of linear spaces. Banach spaces. Unitary linear spaces. Hilbert spaces. Real-valued, complex-valued vector-valued random variables. Stochastic sequence, stochastic process. Probability distributions, distribution function, basic properties, applications. Frequently used probability distributions. Probability density functions. Generalised density functions. Frequently used density functions. Characterisation of random variables by numerical values. Expectation, standard deviation and higher momentums. Random variables in L2. Characterisation of the Borel-measurable functions of random variables. Conection between the generator function and the characteristic function. Markov- and Cheishev-unequalities. Distribution function and density function for vector valued random variables. Marginal distribution function and density function. Expected vector and standard deviation matrix. Covariance and correlation. Condirtional distribution function and density function. Special case of zero probability condition. Conditional expectation. Regression function. Connection between two random variables. Pair-wise and complete independence of random variables. Operations among random variables, distribution of sum, product, quotient of random variables. Convergence concepts for random variable sequences. The weak law of large numbers. Central limit theorem.

15. Description of practices

16. Description of labortory practices

17. Learning outcomes

A. Knowledge B. Skills

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: methods of the treatment of the stochastic systems and processes; probability theory and random variables, typical distribution and density functions of random variables; typical mapping procedures; the law of large numbers, central limit theorem.

C. Attitudes D. Autonomy and Responsibility

- Students must persue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new reasurce activities in new fields of knowledge in an innovative way.

18. Requirements, way to determine a grade (obtain a signature)

Regular participation at the lectures and written exam.

19. Opportunity for repeat/retake and delayed completion

According to the TVSZ

20. Learning materials

1. Zobory, I.: Sztochasztikus folyamatok a rendszerdinamikában I. Kézirat. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2011.
2. Arnold, L.: Sztochasztikus differenciálegyenletek Tipotex, Budapest, 2013.

Effective date	27 November 2019	**This Subject Datasheet is valid for**	Inactive courses