Budapest University of Technology and Economics
Faculty of Transportation Engineering and Vehicle Enginee

1. Subject name	**Vehicle system dynamics I.**				
2. Subject name in Hungarian	Járműrendszerdinamika I.				
3. Code	**BMEKOVJD007**	**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					

14. Description of lectures

Investigation method used for treating the problems of system dynamics. System identification via the least-squares' method. Characterisation of mechanical systems by means of logical flow-charts. Logical flow-chart of vibration system excited by kinematical load or force load. Logical flow chart of a block braked vehicle wheel taking into consideration the tribological characteristics of the sliding friction and the rolling contact. Flow chart for the starting process of a vehicle drive system. Dynamical model of the speed regulator system for a Diesel-engine. Simplified flow-chart of the engine – regulator system. Construction of the system equations of the regulator taking into consideration an ideal engine, sliding friction as well as a hydraulic amplifier. Representation of dynamical systems by structure graph. Analogies between mechanical and electric systems. Description of the node and loop equations of dynamical networks. Elementary relations for the source-free bows. Mechanical impedance. Examples for the construction of structure graphs of excited and damped vibratory systems in the presence of complex valued periodic and non-periodic excitations. Representation of dynamical systems by signal flow graph. Construction of the motion equations of lumped parameter dynamical systems by synthetic and analytic methods. Lagrangean equations of second kind. The general theory of linear dynamical systems. System description in the time domain: the weighting function and the transition function. Treating of the systems with excitation: the convolution integral and the Duhamel-integral. System description in the frequency domain. The complex frequency function. Analysis of the reponse of linear systems excited by periodic, non-periodic or in 2nd order weakly stationary random excitations. Analysis of the outputs in the case of MIMO system. The coherency function and its applications.

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: application of flow-charts, structure graphs and signal-flow-graphs for analysing vehicle dynamical systems; analytic and sintetic methods for generation motion equations; methods of characterisation of dynamic systems in the time- and frequenty-domains.

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.: Járműrendszerdinamika I. Kézirat. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2011.
2. Brown, F.T.: Engineering System Dynamics. Taylor & Francis, Boca Raton, London, New-York, 2007

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