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

1. Subject name	**Vehicle system dynamics III.**				
2. Subject name in Hungarian	Járműrendszerdinamika III.				
3. Code	**BMEKOVJD014**	**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. Szabó András				
12. Lecturers	Dr. Szabó András				
13. Prerequisites	**recommended: BMEKOVJD008 - Vehicle system dynamics II.**				

14. Description of lectures

Distributed parameter beam model of the transportation track on elastic foundation. Treatment of the moving load acting on the track model. Models of system dynamics: lumped parameter models, distributed parameter models and hybrid models. Connecting the track/vehicle models, complex model formation. The degree of freedom of the models. Constraint equations. Gravity point position characterising free coordinates and acceleration-coupled systems. Forces arising in the track/vehicle system. Geometric and parametric track irregularities acting on the system as excitation effects. Generation of the motion equations of the system by synthetic method. Specifying the wheel and rail profiles. Computing the normal forces acting on the rail surface. Prediction of the wheel and rail wear by simulation. Conditions of the stable running. Numerical stability analysis. Nonlinear effects after loss of dynamical stability, the limit-cycle motion. The lateral dynamical model of the railway track/vehicle system using the continuum model of the track. Numerical simulation. Beam models of different detail level of the railway track for moving vertical loads. Solution to the boundary value problem. Treatment of the complex coefficient algebraic equation emerging in the course of the numerical analysis. The combined modelling of the track and the lumped parameter vehicle moving along it, as a hybrid dynamical system.

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: possibilities for modelling the railway-track/vehizle dynamical system; methods of generating the system-equations; transformation procedures connected to the system modelling; solution methods for the geometrical contact of wheel and rail; possibilities of taking into consideration the parametric excitation caused by the track stiffness inhomogenity.

C. Attitudes D. Autonomy and Responsibility

- Students must pursue 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. Szabó, A.: Járműrendszerdinamika III. Kézirat. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2012.

2. Zoller, V.: Elosztott paraméteres és hibrid drinamikai rendszerek. BME Vasúti Járművek és Jármű-rendszeranalízis Tanszék. Budapest, 2011.
3. Zábori, Z.. Hibrid közlekedési pálya-jármű rendszer keresztirányú dinamikája. Kézirat. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2010.

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