

Course description

Course abbreviation:	KKS/PPZ	Page:	1 / 4
Course name:	Service Strength and Life of Transport		
Academic Year:	2023/2024	Printed:	03.06.2024 08:21

Department/Unit /	KKS / PPZ			Academic Year	2023/2024
Title	Service Strength and Life of Transport			Type of completion	Exam
Long Title	Service Strength and Life of Transport Vehicles and Handling Machinery				
Accredited/Credits	Yes, 3 Cred.			Type of completion	Combined
Number of hours	Lecture 2 [Hours/Week] Tutorial 2 [Hours/Week]				
Occ/max	Status A	Status B	Status C	Course credit prior to	NO
Summer semester	0 / -	0 / -	0 / -	Counted into average	YES
Winter semester	0 / -	0 / -	1 / -	Min. (B+C) students	5
Timetable	Yes			Repeated registration	NO
Language of instruction	Czech			Semester taught	Winter semester
Optional course	Yes			Internship duration	0
Evaluation scale	1 2 3 4				
No. of hours of on-premise					
Auto acc. of credit	Yes in the case of a previous evaluation 4 nebo nic.				
Periodicity	K				
Substituted course	None				
Preclusive courses	N/A				
Prerequisite courses	N/A				
Informally recommended courses	N/A				
Courses depending on this Course	N/A				

Course objectives:

The aim of this course is to provide students with information about the cycle of design, dimensioning and testing of strength and fatigue life of the mechanical parts of both road and rail vehicles and handling machinery. Computational methods, experiments in testing laboratories, experiments on the test tracks and polygons, experiments on the real tracks will be described. The legislation from this area will be introduced.

Requirements on student

Minimal 75% participation on lectures.
Participation on selected field trip.
Final assessment: combined examination (written and oral)

Content

An overview of selected applications of computational and experimental mechanics at development and testing of transport vehicles and handling machines. These parts of solution are presented: service strength and fatigue life, deformation resistance and passive safety. The design and examination of the structures are applied in compliance with the binding standards, instructions and processes of homologation.

1. Introduction into the course. Definition of service strength and life. Demands on designer thinking. Learning from service failures of real structures.
2. Factors influencing service strength. Material properties, work loads of machines, geometry and shape of components, production technologies and surfacing.
3. Factors influencing service strength and life. Basic classification of limiting states.
4. Relationship between service strength and life with operational reliability. Reliability of mechanical systems. Measures for increasing of reliability.
5. Philosophy of dimensioning and evaluation of strength and life of structural parts. Dimensioning by safety coefficients, dimensioning by limit states, prospects of probabilistic approach.
6. Strength and service life of road vehicles: the cycle of design, dimensioning and testing of strength and fatigue life of the road vehicles mechanical parts. Information on existing legislation (standards, regulations, vehicles homologation). Computational

methods, experiments in testing laboratories, experiments on the test tracks and polygons, experiments on the real tracks.

7. Strength and service life of road vehicles - continuation.

8. Strength and service life of rail vehicles: The cycle of design, dimensioning and testing of strength and fatigue life of the rail vehicles mechanical parts. Information on the existing legislation (standards, regulations, vehicles homologation). Computational methods, experiments in testing laboratories, experiments on test tracks, experiments on real tracks.

9. Strength and service life of rail vehicles - continuation.

10. Strength and service life of handling machines. The cycle of design, dimensioning and testing of strength and fatigue life of the mechanical parts. Information on the existing legislation (standards, regulations, homologation). Computational methods, experiments in testing laboratories, experiments in real operational conditions.

11. Examples of solution in the field of road vehicles.

12. Examples of solutions in the field of rail vehicles.

13. A field trip in the selected workplace.

Fields of study

viz COURSEWARE

Guarantors and lecturers

- **Guarantors:** Ing. Pavel Žlábek, Ph.D. (100%)
- **Lecturer:** Doc. Ing. Miloslav Kepka, CSc. (50%), Ing. Pavel Žlábek, Ph.D. (50%)
- **Tutorial lecturer:** Doc. Ing. Miloslav Kepka, CSc., Ing. Pavel Žlábek, Ph.D. (100%)

Literature

- **Basic:** Růžička, Milan; Hanke, Miroslav; Rost, Milan. *Dynamická pevnost a životnost*. Praha : ČVUT, 1992.
- **Basic:** Kepka, Miroslav. *Management výpočtových a experimentálních metod pro vývoj spolehlivých dopravních prostředků*. V Praze : ČVUT, 2006. ISBN 80-01-03436-4.
- **Basic:** Mezní stavy a spolehlivost (Vlk, Miloš; Florian, Zdeněk) - <http://www.zam.fme.vutbr.cz/~vlk/meznistavy.pdf>
- **Basic:** Lauschmann, Hynek. *Mezní stavy I. Únava materiálu*. ČVUT v Praze, 2007. ISBN 978-80-01-03671-6.
- **Extending:** Haibach, Ervin. *Betriebsfestigkeit - Verfahren und Daten zur Bauteilberechnung*. 2005. ISBN 978-3-540-29363-7.
- **Recommended:** Vlk, František. *Zkoušení a diagnostika motorových vozidel*. Brno : Nakladatelství a vydavatelství Vlk, 2001. ISBN 80-238-6573-0.
- **Recommended:** First, Jiří. *Zkoušení automobilů a motocyklů : příručka pro konstruktéry*. Praha : S&T CZ, 2008. ISBN 978-80-254-1805-5.

Time requirements

All forms of study

Activities	Time requirements for activity [h]
Contact hours	26
Preparation for an examination (30-60)	60
Attendance on a field trip (number of real hours - maximum 8h/day)	8
Total:	94

assessment methods

Knowledge - knowledge achieved by taking this course are verified by the following means:

Oral exam

Skills - skills achieved by taking this course are verified by the following means:

Test

Competences - competence achieved by taking this course are verified by the following means:

Oral exam

prerequisite**Knowledge - students are expected to possess the following knowledge before the course commences to finish it successfully:**

- have good knowledge of at least one foreign language
- know the limit states of materials and structures under their static, cyclic and dynamic loading
- list and explain the main technologies for manufacturing machine parts
- understand the basic principles of construction and design of road and rail vehicles

Skills - students are expected to possess the following skills before the course commences to finish it successfully:

- be able to calculate internal forces in simple mechanical systems
- be able to calculate stress distribution in basic cross-sections of machine parts
- be able to obtain information from professional foreign sources
- be able to realize and evaluate basic mechanical tests of materials

Competences - students are expected to possess the following competences before the course commences to finish it successfully:

N/A

N/A

N/A

teaching methods**Knowledge - the following training methods are used to achieve the required knowledge:**

- Field trip
- Lecture supplemented with a discussion
- Multimedia supported teaching
- E-learning

Skills - the following training methods are used to achieve the required skills:

- Individual study
- Practicum
- Students' portfolio
- Multimedia supported teaching
- E-learning

Competences - the following training methods are used to achieve the required competences:

- Individual study
- E-learning
- Multimedia supported teaching

learning outcomes**Knowledge - knowledge resulting from the course:**

- have basic knowledge about various processes of operational loading of structures and possibilities of their simulation in laboratory conditions using loading equipment
- know the principles of dimensioning components for durability and safe life and distinguish between different approaches to assess their reliability
- understand the basics of reliability of mechanical systems and know the measures to increase the reliability of structural systems and their parts

Skills - skills resulting from the course:

- be familiar with the standards and regulations concerning the testing of road and rail vehicles

coordinate designers' collaboration with computing specialists and test engineers to address operational strength and fatigue lifetime issues

propose the main parameters of laboratory and operational tests of vehicles and their components and to know what procedures and methods to evaluate these tests

Competences - competences resulting from the course:

N/A

N/A

Course is included in study programmes:

Study Programme	Type of	Form of	Branch	Stage	St. plan v.	Year	Block	Status	R.year	R.
Design Engineering of Machines and Technical Devices	Postgraduate Master	Combined	Design Engineering of Vehicles and Handling Machinery	1	2020	2023	Core elective courses "B"	B	2	ZS
Design Engineering of Machines and Technical Devices	Postgraduate Master	Full-time	Design Engineering of Vehicles and Handling Machinery	1	2020	2023	Core elective courses "B"	B	2	ZS