

Vehicle Design and Diagnostics

Code: MK3JATVJ04JX20-EN

Evaluation: exam

ECTS Credit Points: 4

Semester: 6th semester

Its prerequisite(s): Vehicle and Drive Elements I

Further courses are built on it: Yes/No

Number of teaching hours/week (lecture + practice): 2+2

Topics:

Basics of the reliability theory and its role in the vehicle industry. Qualitative and quantitative methods of the reliability analysis. Definition of the failure probability and the theoretical and experimental basics of its estimation. Definition of the load spectrum, its fundamental types, standards. Definition of the S-N curve and its connection to the Haigh-diagram. The Palmgren-Miner methods. The probability theory approach to the safety factor.

Fundamental definitions of the tribology. Friction states, dry friction, friction in the presence of lubrication. The elastohydrodynamic lubrication state. Mechanisms of wearing, types of wearing. Influencing factors of the wearing resistance.

Definition of the numerical structural analysis, generating numeric models based on geometric models. Practical applications of the finite element method in the vehicle industry. Practical role of the numerical simulation in the vehicle industry.

Laboratory practice:

Solving of numerical simulation problems during seminars.

Literature:

Compulsory:

- Lewis, E.E.: Introduction to Reliability Engineering. Second Edition. John Wiley & Sons, Inc. New York 1996.
- O'Connor, P.D.T.: Practical Reliability Engineering. Third Edition. John Wiley & Sons Chichester...1997.
- Stephens, R. I., Fatemi, A., Stephens, R. R., Fuchs, H.O.: Metal Fatigue in Engineering. Second Edition. John Wiley & Sons Inc. New York, 2001.
- G.R. Liu, S. S. Quek: Finite Element Method: A Practical Course. Elsevier, 2003. ISBN 0080472761

Schedule

1st week Registration week

2nd week:

Lecture: Basics of the reliability theory and its role in the vehicle industry. Qualitative and quantitative methods of the reliability analysis.

3rd week:

Lecture: Definition of the failure probability and the theoretical and experimental basics of its estimation.

Practice: Calculation problems.	Practice: Calculation problems.
4th week: Lecture: Definition of the load spectrum, its fundamental types, standards Practice: Calculation problems.	5th week: Lecture: Definition of the S-N curve and its connection to the Haigh-diagram. Practice: Calculation problems.
6th week: Lecture: The Palmgren-Miner methods. Practice: Calculation problems.	7th week: Lecture: The probability theory approach to the safety factor. Fundamental definitions of the tribology. Practice: Calculation problems.
8th week: Mid-term test	
9th week: Lecture: Friction states, dry friction, friction in the presence of lubrication. Practice: Calculation problems.	10th week: Lecture: The elastohydrodynamic lubrication state. Practice: Calculation problems.
11th week: Lecture: Mechanisms of wearing, types of wearing. Practice: Calculation problems.	12th week: Lecture: Influencing factors of the wearing resistance. Practice: Calculation problems.
13th week: Lecture: Definition of the numerical structural analysis, generating numeric models based on geometric models. Practice: Calculation problems.	14th week: Lecture: Practical applications of the finite element method in the vehicle industry. Practical role of the numerical simulation in the vehicle industry. Practice: Calculation problems.
15th week: End-term test	

Requirements

A, for a signature:

Participation in practice classes is compulsory. Students must attend practice classes and may not miss more than three occasions during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students can't take part in any practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent to an absence. In case of further absences, a medical certification needs to be presented. Missed practice classes must be made up for at a later date, being discussed with the tutor.

During the semester there are two tests: the mid-term test on the 8th week and the end-term test on the 15th week. Students must sit for the tests.

B, for a grade (ESE):

The course ends with an **examination**.

The minimum requirement of the mid-term test and the end-term test is 50% separately. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

The grade is given according to the following table:

%	Grade
0-49	fail (1)
50-62	pass (2)
63-75	satisfactory (3)
76-89	good (4)
90-100	excellent (5)

If the score of any test is below 50%, the student once can take a retake test of the whole semester material.

An offered grade: It may be offered for the students if the average of the mid-term test, end-term tests and the teamwork is at least good (4). The offered grade is the average of them.

Measurement Technology

Code: MK3MERTR04JX20-EN

ECTS Credit Points: 4

Evaluation: mid-semester grade, measurement report

Semester: 3rd semester

Its prerequisite(s): Electrotechnics and Electronics

Further courses are built on it: Yes/No

Number of teaching hours/week (lecture + practice): 2+2

Topics:

Detectors (sensors) and transducers. Grouping the sensors. The measuring device structure and characteristics. Unit of measurement systems. Measurement error. Measurement methods. Electro-mechanical - and electronic instruments. Digital instruments. Microelectronic sensors. Elastic deformation measuring devices. Temperature, light and radiation detectors. Thermocouples, thermometers metal, semiconductor thermometers-; Optical gates-; Capacitive proximity switches-; Ultrasonic sensors-; structure, operating principles and properties. Foil Version strain gauges, semiconductor strain gauges, strain sensor wire, one, two and four-sensor bridge circuit. Fiber optic sensors. Signal processing systems. Pressure, temperature, strain and measurement of rotary motion using National Instruments LabVIEW software.

Literature:

Compulsory:

- Aciatore, David G.: Introduction to mechatronics and measurement systems, Boston, 2007, ISBN:007 125407 2

- Ed. Robert H. Bishop: The Mechatronics Handbook, Section III: Sensors and actuators, CRC Press; 2nd edition 2007, ISBN: 978-0849392573

Recommended:

- David G. Alciatore, Michael B. Hstand: Introduction to mechatronics and measurement systems 1st. McGraw-Hill, 2013. ISBN: 978-0073380230
- Uday A. Bakshi, Varsha U. Bakshi:: Electronic Measurement and Instrumentation 1st. Technical Publications Pune, 2009. ISBN: 9788184315295

Schedule

1st week Registration week	
2nd week: Lecture: Basic concepts of measurement. Sensors (sensors) and transducers. The sensors are grouped. The structure and characteristics of the measuring apparatus. Measurement Systems. Measurement errors. Measurement methods. Practice: General description about laboratory regulations. Accident prevention and safety education. 4th week: Lecture: Types of photo resist and application. The structure and features of a phototransistor. The structure and use of a light pencil. The structure, characterization and application of a liquid crystal display. Practice: Measurement of LED characteristics. 6th week: Lecture: Thermoelectric sensors. The operating principles, construction and characteristics of an infrared motion sensor. Thermoelectric transducer coupling, the PVDF film. Thermocouples, semiconductor structure, function and features of metal thermometers and other thermometers. Practice: Measurement of temperature.	3rd week: Lecture: Theoretical basis of Light electric effect sensors. The photodiode and photovoltaic structure, modes of operation and application. Multi-colour LEDs. The structure and characteristics of optical interfaces. The scanner structure and characteristics of CCD sensors. Practice: Examination of solar cell. 5th week: Lecture: Measuring elastic deformation instruments. Piezoelectric and piezoresistive sensors. Elastic deformation measuring instruments. Bellows. Microelectronic capacitive pressure sensors. PN-gradient sensors and the MOSFET structure. Practice: Measurement of elastic deformation 7th week: Lecture: An optical gate. Its structure, working principle and characteristics and application areas. Practice: Measurement of an optical gate.
8th week: 1st drawing week	Mid-term test
9th week:	10th week:

Lecture: A capacitive proximity switch. Its structure, working principle, characteristics and application areas.

Practice: Measuring of capacitive proximity switch.

11th week:

Lecture: Strain gages. Foil strain gauges, semiconductor strain gauge, strain sensor wires, one, two and four-sensing bridge circuits.

Practice: Measuring of strain gages.

13th week:

Lecture: Description of the main features of the NI LabVIEW software.

Practice: National Instruments with hardware and software. Edit VI. Measuring system construction, Troubleshooting practice

Lecture: Ultrasonic sensors. Their structures, working principles, characteristics, and application areas.

Practice: Measuring of an ultrasonic distance sensor.

12th week:

Lecture: The Reed switch and magneto inductive sensors. Their structures, working principles, characteristics and Application areas.

Practice: Measuring of reed switch.

14th week:

Lecture: Structure of the NI data acquisition systems. DAQ connecting to your computer.

Practice: Recording and evaluation of data measured by National Instruments Hardware

15th week: 2nd drawing week: End-term test

Requirements

A, for a signature:

Attendance at lectures is recommended, but not compulsory. Attending practices is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student cannot make up a practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with absence. Missed practices should be made up for at a later date, being discussed with the tutor. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct doesn't meet the requirements of active participation, the teacher may evaluate his or her participation as an absence because of the lack of active participation in the class. Students have to submit all the twelve reports as scheduled minimum at a sufficient level. During the semester there are two tests: the mid-term test is in the 8th week and the end-term test in the 15th week.

B, for grade:

Based on the average of the grades of the reports and the test results, the mid-semester grade is calculated as an average of them: - the average grade of the twelve reports (50 %) - the grade of the tests (50 %). The minimum requirement for end-term test is 60%. Based on the score of the test separately, the grade for the test is given according to the following table: Score Grade 0-59 fail (1) 60-69 pass (2) 70-79 satisfactory (3) 80-89 good (4) 90-100 excellent (5)