*Recommended template: “Course Description, Syllabus, Course Requirements”*

# course syllabus and course requirements academic year 2022/2023 semester 2

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| --- | --- |
| Course title | Termékmegbízhatóság (Product Reliability) |
| **Course Code** | **SZB088AN** |
| **Hours/Week: le/pr/lab**  | **2 / 0 / 0** |
| **Credits** | **2** |
| **Degree Programme** | **all** |
| **Study Mode**  |  |
| **Requirements** | **Mid-semester grade** |
| **Teaching Period** | **Spring** |
| **Prerequisites** | **none** |
| **Department(s)****Course Director** | **Department of Electrical Networks****Dr. Molnár László Milán assistant professor** |
| **Teaching Staff** | **Dr. Molnár László Milán assistant professor** |
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# course description

*A short description of the course (max. 10 sentences).*

*Neptun: Instruction/Subjects/Subject Details/Basic data/Subject description*

The course aims to give an introduction to reliability engineering, focusing on product design aspects, testing methods and statistical evaluation of tests.

# syllabus

*Neptun: Instruction/Subjects/Subject Details/Syllabus*

## **goals and objectives**

*Goals, student learning outcome.*

*Neptun: Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction*

Basic terms in reliability engineering

Reliability as a probability, intended product functions, requirements (e.g. warranty time, lifetime), failure mode, failure mechanism, mission profiles. Load, load capability, stress, strength.

Statistical description

Statistical functions: failure parameters, failure rate, hazard function. MTTF, MTBF.

Reliability-related distrubutions: lognormal, Weibull, exponential. Bathtub curve.

Evaluation of

Load capability vs. Load distribution

Analysis of mission profiles, use case analysis

Nature of failures

Load paths, conversion of internal and external loads

Typical failure mechanisms

Mechanical failure mechanisms, e.g. creep, fatigue, overstress

Corrosion, electrochemical migration

Semiconductor failure mechanisms

Examples of conversion of loads to failures

 Test and validation strategies

Basic concepts: End-of-life testing, Validation testing

Endurance tests

Impact tests (mechanical, IP tests etc.)

Environmental tests

Conversion from life to lab: Accelerated lifetime tests and their evaluation, acceleration models of failure mechanisms

Decomposition of load types, cross-effects

Basics of systems reliability

Functional block diagram, fault tree analysis (FTA)

Concurrent failures

Reliability partitioning

Redundancy

## **course content**

*Neptun: Instruction/Subjects/Subject Details/Syllabus/Subject content*

|  |  |
| --- | --- |
|  | TOPICS |
| LECTURE | *1.- 4.: Theoretical reliability colculations**5.-6.: Reliability tests**7.-10.: Design for Reliability* |

### **DETAILED SYLLABUS AND COURSE SCHEDULE**

### *academic holidays included*

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| --- |
| LECTURE  |
| week | **Topic** | **Compulsory reading; page number****(from … to …)** | **Required tasks (assignments, tests, etc.)** | **Completion date, due date** |
| 1. | Introduction of reliability. Basic definitions. | [1] Section 1 |  | 2023.02.06. |
| 2. | Statistical description of reliability-related terms I. | [1] Section 2 to 2.1.3 |  | 2023.02.13. |
| 3. | Statistical description of reliability-related terms II. | [1] Section 2.2-2.3 |  | 2023.02.20. |
| 4. | Statistical description of reliability-related terms III. – important distributions | [1] Section 2.3 |  | 2023.02.27. |
| 5. | Assessment of Lifetime tests and failure statistics | [1] Section 2.3 |  | 2023.03.06. |
| 6. | Accelerated lifetime tests, conversion from lab test to real life | [1] Section 6 |  | 2023.03.13. |
| 7. | Mid-term |  |  | 2023.03.20. |
| 8. | Concept of Design for Reliability; Concept of load vs. Strength comparison | [1] Section 6 |  | 2023.03.27. |
| 9. | Spring holiday (no lecture) | 2023.04.03. |
| 10. | Easter (public holiday) | 2023.04.10. |
| 11. | Mathematical description of loads | [1] Section 6 |  | 2023.04.17. |
| 12. | System structuring, functional graph | [1] Section 6 |  | 2023.04.24. |
| 13. | Labour’s Day (public holiday) | 2023.05.01. |
| 14. | Reliability testing, test types and their dependency on loads | [1] section 8. |  | 2023.05.08. |
| 15. | Supplementary mid-term + presentations |   |  | 2023.05.15. |

## **assessment and evaluation**

*(Neptun: Instruction/Subjects/Subject Details/Syllabus/Examination and Evaluation System)*

##### **Attendance**

*In accordance with the Code of Studies and Examinations of the University of Pécs, Article 45 (2) and Annex 9. (Article 3) a student may be refused a grade or qualification in the given full-time course if the number of class absences exceeds 30% of the contact hours stipulated in the course description.*

***Method for monitoring attendance*** *(e.g.: attendance sheet / online test/ register, etc.)*

None

##### **assessment**

*Cells of the appropriate type of requirement is to be filled out (course-units resulting in mid-term grade or examination). Cells of the other type can be deleted.*

Course resulting in mid-term grade (PTE TVSz 40§(3))

**Mid-term assessments, performance evaluation and their ratio in the final grade** (The samples in the table to be deleted.)

|  |  |  |
| --- | --- | --- |
| **Type** | **Assessment** | **Ratio in the final grade** |
| *Mid-term test* | *max. 40 points* | *40%* |
| *Essay homework + presentation* | *max 60 points* | *60%* |

**Opportunity and procedure for re-takes** (PTE TVSz 47§(4))

*The specific regulations for improving grades and resitting tests must be read and applied according to the general Code of Studies and Examinations. E.g.: all tests and assessment tasks can be repeated/improved at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.*

Mid-term test can be repeated during any lecture after 10th April 2023.

Deadline for Essay homework is 10th May 2023, not possible to extend.

**Grade calculation as a percentage**

based on the aggregate performance according to the following table

|  |  |
| --- | --- |
| **Course grade** | **Performance in %**  |
| excellent (5) | 85 % … |
| good (4) | 70 % ... 85 % |
| satisfactory (3) | 55 % ... 70 % |
| pass (2) | 40 % ... 55 % |
| fail (1) | below 40 %  |

The lower limit given at each grade belongs to that grade.

## **Specified literature**

*In order of relevance. (In Neptun ES: Instruction/Subject/Subject details/Syllabus/Literature)*

##### **compulsory reading and availability**

[1.] B. Bertsche: Reliability in Automotive and Mechanical Engineering, print ISBN 978-3-540-33969-4

[2.] Patrick D.T. O’Connor & Andre Kleyner: Practical Reliability Engineering, print ISBN 9780470979822