COURSE SYLLABUS AND COURSE REQUIREMENTS
ACADEMIC YEAR 2023/2024 SEMESTER 2

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)	Department of Electrical Networks
Course Director	Dr. Molnár László Milán assistant professor
Teaching Staff	Dr. Molnár László Milán assistant professor

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

1. 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

2. 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

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		2024.02.05.
2.	Statistical description of reliability-related terms I.	[1] Section 2 to 2.1.3		2024.02.12.
3.	Statistical description of reliability-related terms II.	[1] Section 2.2-2.3		2024.02.19.
4.	Statistical description of reliability-related terms III. – important distributions	[1] Section 2.3		2024.02.26.
5.	Assessment of Lifetime tests and failure statistics	[1] Section 2.3		2024.03.04.
6.	Accelerated lifetime tests, conversion from lab test to real life	[1] Section 6		2024.03.11.
7.	Mid-term			2024.03.18.
8.	Concept of Design for Reliability; Concept of load vs. Strength comparison	[1] Section 6		2024.03.25.
9.	Spring holiday (no lecture)			2024.04.01.
10.	Mathematical description of loads	[1] Section 6	1-4.	2024.04.08.
11.	System structuring, functional graph	[1] Section 6		2024.04.15.
12.	System structuring, functional graph	[1] Section 6	5-6.	2024.04.22.
13.	Reliability testing, test types and their dependency on loads	[1] section 8.		2024.04.29.
14.	Supplementary mid-term + presentations		7.	2024.05.06.

3. 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%*

Essay homework details (each point is referred in the Schedule table.)

1. *(5%) Describe your **target system**! In case of complex products, you may choose a group of connected components!*
   - ✓ *Define functions of your target system and break down your system into components to at least 1 sub-level!*
2. *(10%) Describe **normal usage conditions**, and brainstorm **misuse cases**! Usage can be defined by a set of user stories and quantification of their usage conditions (environmental and user-related as well)*
3. *(5%) Draw the **reliability diagram** for your target system!*
   - ✓ *Pick one component in your system! → **„critical component"***
4. *(10%) Identify **all failure modes** of the critical component and perform a **failure mode – failure mechanism analysis** and choose **one failure mechanism** which is easy to describe.*
   - ✓ *E.g. fracture above yield strength*
5. *(10%) Describe the **loads acting on your critical component**! Description should cover:*
   - ✓ *Load types,*
   - ✓ *Quantification possibilities (physical units etc.), or model approximations*
   - ✓ *Set up mission profile (in the book it is called: „load collective")*
6. *(5%) Describe the **strength of your critical component**!*
   - ✓ *Physical quantification*
   - ✓ *Material properties (in case there is any)*
7. *(15%) Propose a **test plan** to ensure reliability! This should cover all load types.*
   - ✓ *You should decide about target lifetime, reliability, confidence level,*
   - ✓ *Other aspects of test planning (e.g. test sample amount, test circumstances, censored or complete test…)*

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 8th April 2024.
Deadlines for homework will be published in Moodle. Missing the deadline will mean zero points of that part.

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.

4. 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