



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Non-destructive testing [S1Trans1>BN]

### Course

Field of study

Transport

Year/Semester

3/6

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

full-time

Requirements

elective

### Number of hours

Lecture

30

Laboratory classes

15

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

### Number of credit points

2,00

### Coordinators

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### Lecturers

### Prerequisites

**KNOWLEDGE:** Knowledge of basic knowledge in physics, chemistry as well as mechanics and strength of materials in the scope enabling explaining the essence of non-destructive testing methods. **SKILLS:** The ability to use scientific and technical literature in the field of physics, chemistry, fracture mechanics in Polish and English, and the ability to use the acquired knowledge in understanding material discontinuities and non-destructive testing methods. **SOCIAL COMPETENCES:** Awareness of ensuring that the products and used elements of machines and means of road transport are of appropriate quality and safe when used in the social environment.

### Course objective

To acquaint students with selected examples of material discontinuities (defects, cracks) generated in the processes of manufacturing and operation of machine elements and means of road transport, as well as with the basic methods of non-destructive testing for detecting discontinuities during manufacturing and operation.

### Course-related learning outcomes

Knowledge:

1. Has extended and deepened knowledge of physics useful for formulating and solving selected technical tasks, in particular for correct modeling of real problems.
2. Has a basic knowledge of the life cycle of means of transport, both hardware and software, and in particular about the key processes taking place in them.
3. Knows the basic techniques, methods and tools used in the process of solving tasks in the field of road transport, mainly of an engineering nature.

#### Skills:

1. Is able, when formulating and solving tasks in the field of transport, to apply appropriately selected methods, including analytical, simulation or experimental methods
2. is able to take into account in the process of formulating and solving tasks in the field of transport engineering also non-transport aspects, in particular social, legal and economic issues
3. Can make a critical analysis of the functioning of transport systems and other technical solutions and evaluate these solutions, including: can effectively participate in technical inspection and assess the road transport task from the point of view of non-functional requirements, has the ability to systematically conduct functional tests.

#### Social competences:

1. Is aware of the social role of a technical university graduate, in particular understands the need to formulate and convey to the society, in an appropriate form, information and opinions on engineering activities, technological achievements, as well as the achievements and traditions of the profession of a road transport engineer.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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The learning outcomes in this subject are checked with a test containing 10 questions, covering general issues related to non-destructive testing, i.e. types of discontinuities and their location, and the most important kinds of non-destructive testing methods.

Practical skills acquired during the implementation of laboratory exercises are checked on the basis of laboratory reports.

The threshold for passing the knowledge of the subject is 50% of the points obtained from the written test, covering all the issues specified in the course program.

### Programme content

The module programme covers the following topics:

1. Explanation of the essence of non-destructive testing
2. Material discontinuities
3. Penetrant discontinuity detection method (PT)
4. Magnetic and magnetic particle method (MT)
5. Ultrasonic method of discontinuity detection (UT) and measurement of properties
6. Other non-destructive testing methods
7. Miscellaneous related to non-destructive testing

### Course topics

The lecture programme covers the following topics:

1. Stages of development of the non-destructive methods, examples of their applications in technology and other areas of practical human activity, and development trends of these methods.
2. Examples of material discontinuities, their generic division depending on the location in the tested element, the most important examples of discontinuities, affecting the safe use of machines and means of road transport.
3. The essence of penetrant testing, advantages and disadvantages, limitations, the procedure for discontinuity detection, equipment and materials to be used in this method and methods of interpretation of test results.
4. The essence of magnetic and magnetic particle method, advantages and disadvantages, limitations, discontinuity detection procedure, equipment and materials to be used in this method and methods of interpretation of test results.

5. The essence of ultrasonic method of discontinuity detection and measurement of properties, advantages and disadvantages, limitations, procedure for discontinuity detection, apparatus and equipment to be used in this method, as well as research techniques and methods of interpretation of results.
6. Optical (endoscopic) methods, radiographic method, eddy current method, methods using the Barkhausen effect, magnetic material memory, etc.
7. Health and safety during the application of non-destructive testing methods, courses for obtaining qualifications and improvement - training and certification system. Specific examples of the use of NDT methods to solve technical problems. Sources of knowledge, standards, instructions for non-destructive testing.

The laboratory programme covers the following topics:

1. Introduction, Health and Safety. Basics of ultrasonic testing, thickness measurements of single-sided components.
2. Assessment of adhesion and thickness of adhesive coatings.
3. Testing of welded and soldered joints.
4. Non-destructive testing by visual methods.
5. Non-destructive testing by penetration method.
6. Magnetic particle testing and inspection.
7. Ultrasonic testing of welded joints.

### Teaching methods

1. Lecture with multimedia presentation.
2. A set of videos illustrating the essence of individual methods and examples of their application.
2. Laboratory classes - performing the tasks given by the teacher - practical exercises.

### Bibliography

Basic:

1. Lewińska-Romicka A. : Badania nieniszczące. Podstawy defektoskopii / Non-destructive testing. Fundamentals of defectoscopy. WNT, Warsaw, 2004 (in Polish).
2. Wojas M. : Wady wyrobów wykrywane metodami nieniszczącymi / Product defects detected by non-destructive methods. Ed. Gamma Office, Warsaw, 2006 (in Polish).
3. Borowiecka A. : Badania penetracyjne / Penetration Testing. Ed. Gamma Office, Warsaw, 2001 (in Polish).
4. Śliwiński A. : Ultradźwięki i ich zastosowania / Ultrasounds and their applications. WNT, Warsaw, 2001 (in Polish).

Additional:

1. Rose J. L.: Ultrasonic Waves in Solid Media. Cambridge University Press, Cambridge, 2009.
2. Bray Don E., Stanley Roderic K.: Nondestructive Evaluation: A Tool in Design, Manufacturing and Service, Mc Grow-Hill, New York, 1998.
3. Deputat J. (Ed.): Nondestructive Testing of Materials and Structures. Institute of Fundamental Technological Research Polish Academy of Sciences, Warsaw, 2004.

### Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	45	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	15	0,50