

**APPROVED BY**

Director of the School of Advanced Manufacturing Technologies  Alexey N. Yakovlev

**Course Name**

*Diagnostics of loaded materials and constructions*

**Field of Study:** Major 22.04.01 Material Science and Technologies

**Programme name:** Material Science

**Level of Study:** Master Degree Programme

**Year of admission:** 2019

**Semester, year:** 2, 2020

**ECTS:** 6

**Total Hours:** 216

**Contact Hours:** 80

- **Lectures:** 16
- **Labs:** 24
- **Practical experience:** 40


**Assessment:** exam

**Division for Materials Science**

**Head of Division for Materials Science**

 Vasiliy A. Klimenov

**Instructor(s)**

 Sergey V. Panin

## Course Name

### Course Overview

<b>Course Objectives</b>	The modern diagnostic and non-destructive testing methods are being studied to obtain knowledge and skills for proper choice of applicable NDT method for particular task and material. Special attention is paid to combined non-destructive testing methods, especially to joint use of acoustic and optical techniques.
<b>Learning Outcomes</b>	<p>Professional competency includes knowing of issues on the research and development of novel materials and structures, in particular:</p> <ul style="list-style-type: none"> <li>- materials for structural and functional applications for different industries, including electronics and medicine, and technology of surface hardening and coating;</li> <li>- principles for design of novel materials – nanostructured, smart, gradient and composite materials with ceramic, metal and polymer matrix;</li> <li>- technologic facilities and devices for surface hardening and coating deposition;</li> <li>- manufacturing processes for advanced materials;</li> <li>- methods for investigation of properties and diagnostics of loaded materials and structures;</li> <li>- physical and chemical models of materials and manufacturing processes;</li> <li>- law and regulatory issues of application of new materials.</li> </ul>
<b>Course Outline</b>	The course involves lectures, practical classes and laboratory works. Physical principles of non-destructive testing methods. Application of various NDT for inspection machine parts and structure elements in various engineering systems;
<b>Prerequisites (if available)</b>	Theory of materials structure; Physical and mechanical properties of materials
<b>Course Structure</b>	<ul style="list-style-type: none"> <li>• Classification of non-destructive testing methods;</li> <li>• X-ray testing</li> <li>• Acoustic methods</li> <li>• Magnetic methods</li> <li>• Tomographic approaches for different methods</li> <li>• Combination of acoustic and optical methods</li> <li>• Other NDT techniques</li> </ul>
<b>Facilities and Equipment</b>	Optical microscopes, Hardness testers, X-ray diffractometer XRD-7000, Transmission electron microscope JEM-2100, Scanning electron microscope JSM-7500, Polymer specimen preparation line (grinders, mixers, extruders, thermopress, etc), Optical profilometer New View 6200, Nano indenter Nanotest 600 and G200 (MTS), Universal electromechanic Inston 5582 and hydraulic BiSS UTM 150 testing machines.
<b>Grading Policy</b>	<p>In accordance with TPU rating system we use:</p> <ul style="list-style-type: none"> <li>- Current assessment which is performed on a regular basis during the semester by scoring the quality of mastering of theoretical material and the results of practical activities (performance tests, perform tasks, problem solving). Max score for current assessment is 60 points, min – 40 points.</li> <li>- Course final assessment (exam/ credit test) is performed at the end of the semester. Max score for course final assessment is 40 points, min – 22 points.</li> </ul> <p>The final rating is determined by summing the points of the current assessment during the semester and exam (credit test) scores at the end of the semester. Maximum overall rating corresponds to 100 points, min pass score is 80.</p>

<b>Course Policy</b>	Class attendance will be taken into consideration when evaluating students' participation in the course. Students are expected to actively engage in class discussions about the assigned readings. Attendance is strictly controlled. All classes is obligatory to presence.
<b>Teaching Aids and Resources</b>	<p><i>Compulsory Readings:</i></p> <p><i>Domestic and international scientific and engineering journals</i></p> <p><i>Nondestructive Testing And Evaluation, Russian Journal of Nondestructive Testing, Journal of Nondestructive Evaluation, Aci Structural Journal, Computer-Aided Civil and Infrastructure Engineering, Insight, Journal of Structural Engineering-Asce, Research In Nondestructive Evaluation, Building and Environment, Electrical Engineering, Journal of Electrical Engineering-Elektrotechnicky Casopis</i></p> <p><i>Additional Readings: Domestic and international scientific and engineering journals</i></p> <p><i>Computational Materials Science, Journal of Reinforced Plastics and Composites, Journal of Thermal Analysis and Calorimetry, Engineering Computations, International Journal of Applied Electromagnetics and Mechanics, Journal of Theoretical and Applied Mechanics, Journal of Iron and Steel Research International</i></p> <p><i>Internet: <a href="http://www.tandfonline.com/toc/gnte20/current#.U1dOdz-Sw00">http://www.tandfonline.com/toc/gnte20/current#.U1dOdz-Sw00</a></i></p>
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