TOMSK POLYTECHNIC UNIVERSITY | ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

APPROVED BY

Director of the School of Nuclear Science and Engineering
_____ / Oleg Yu. Dolmatov

**Practical Training**
**Research Activity**

**Field of Study:** Physics
**Programme name:** Condensed Matter Physics
**Level of Study:** Master Degree Programme
**Year of admission:** 2024
**Semester, year:** spring, 2025

**ECTS:** 6
**Total Hours:** 216
**Contact Hours:** 0

- **Lectures:** 0
- **Labs:** 0
- **Practical experience:** 0

**Self-study:** 216

**Assessment:** differential credit test

**Department:** Division for Experimental Physics

**Head of Department** _____ / Andey M. Lider

**Instructor(s)** _____ / Roman S. Laptev
_____ / Andey M. Lider

2024

TOMSK POLYTECHNIC UNIVERSITY ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

# Research Activity

## Practical Training Overview

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| **Practical Training Objectives** | The course is aimed at training specialists able to apply fundamental knowledge in physics to solve scientific research problems; plan and conduct fundamental research on projects in the field of nuclear-physical research, interaction of radiation with matter, modernisation of modern and creation of new methods of studying mechanical, electrical, magnetic, thermal properties of solids; process, analyse and summarise scientific and technical information, advanced domestic and foreign experience in professional activity, make presentations of scientific research.<br>The course goals are in compliance with the goals of master degree program within 03.04.02 Physics. |
| **Learning Outcomes** | Upon the course completion, students will be able to:<br>(a) apply techniques for organizing and performing scientific research work of the team and presentation of results;<br>(b) perform actions to organise research and innovation activities;<br>(c) apply basic techniques of obtaining scientific research results and their generalization to obtain new properties of materials;<br>(d) use in scientific activity the knowledge of fundamental and applied sections of special disciplines in the field of condensed matter physics. |
| **Practical Training Structure** | The practical training "Research Activity" includes independent study in multiple stages:<br>**Section (module) 1.** Preparation stage:<br>- obtaining an individual task for the practice;<br>- general briefing at the department (conducted by the head of the department or his/her deputy for practice): purpose and tasks of practice, procedure of practice, safety on the way to the place of practice; forms of communication with the department are indicated;<br>- interview with the practice supervisor;<br>- receive and processing of documents: referral, prescription and security clearance certificate, medical certificate on necessary vaccinations, contract documents (as required);<br>- obtaining a diary and the rules of drawing up a practice report.<br>**Section (module) 2.** Main stage:<br>- upon arrival at the practice place, after arranging accommodation and employment, informing (by letter, telephone, etc.) the TPU supervisors about their employment and, if any, about any difficulties and misunderstandings that may arise in the future during the practice course;<br>- working with a supervisor from the enterprise (organisation), with whom the workplace, programme, individual assignment |

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| | and procedure of the practice are specified;<br>- the stage of collecting, processing and analysing the obtained information;<br>- work at an enterprise in the field of specialty (the main period of practice);<br>- practice diary management.<br>**Section (module) 3.** Research and/or development work:<br>- fulfilment of the planned scope of research and work within the framework of the assigned subject matter;<br>- processing the available data and analysing the validity of the results obtained;<br>- uncertainty calculation;<br>- practice diary management.<br>**Section (module) 4.** Concluding stage:<br>- preparation of the report and practice diary, submitting it in a bound form for checking to the supervisor from the enterprise (organisation), who on the cover page makes a mark on a five-point system and certifies his signature with a seal;<br>- turning in material assets, literature taken, settlement and dismissal (if any). |
| **Facilities and Equipment** | Practical classes are held in computer-aided classrooms equipped with computer-aided teaching technologies for group work with the appropriate licensed software and access to the Internet for students to process and represent experimental results graphically.<br>To ensure efficient independent study and access to electronic publications each student is provided with a workplace in a computer-aided classroom with access to the Internet within the scope of the subjects studied.<br>For carrying out laboratory classes at the Division of Experimental Physics of the School of Nuclear Science and Engineering, the following state-of-the-art equipment is available: Shimadzu XRD-7000S X-ray diffractometer with vertical high-precision goniometer; laboratory unit for beam processing and magnetron sputtering; Raduga-Spectrum coating machine; hermetically sealed glove box SPEX GB 02M; METAM RV-21 microscope with DIC device; acoustic test bench; hydrogen generator model HyGen 200; DualTrans vacuum gauge; oscilloscope OSU-20; Claind NG 2301 nitrogen generator; vacuum pump NVR; diffusion pump NVD-400; vacuum station DRYTEL1025, MDP AMD4 configuration; hydrogen analyzer for metals and alloys RHEN602; Gas Reaction Controller LP automatic system; controlled gas reactor for studying Gas sorption/desorption processes in metals and alloys at high temperatures. alloys at high temperatures; stationary gas analyser for hydrogen H2 "Verba-SV"; Microhardness tester HV-1000. |
| **Grading Policy** | Evaluation of the quality of learning performance and achievements for the discipline (module) during formative and summative assessment is performed in compliance with “TPU Regulations |

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| | for Formative and Summative Assessment" (rector`s order # 59/од dated as 25.07.2018).<br>Intermediate certification on practice in the form of differentiated credit is carried out in the form of defense of the practice report.<br>The maximum mark for one discipline (module) for one semester is 100 points including:<br>– mastering the discipline content (exam type – pass/fail exam; graded credit test); evaluated in formative assessment and summative assessment (interim attestation) is 100 points;<br>– mastering the discipline content (exam type – exam); evaluated in formative assessment is 80 points and summative assessment (interim attestation) is 20 points;<br>The maximum mark for the course final project (course final paper) for one semester (depending on what is applicable in compliance with curriculum) is 100 points including:<br>– marks for formative assessment is 40 points,<br>– marks for summative assessment (interim attestation, defense) is 60 points.<br>Assessment measures for formative assessment designed for discipline (module) corresponding to learning performance and achievements are stated in the Attachment "Calendar Plan and Assessment Measures for the Course". |
| **Practical Training Policy** | To be allowed to take the final test, a student must attend a minimum of 80% of classroom activities and submit reports for all practical sessions.<br>Evaluation of the quality of learning performance and achievements for the discipline (module) during formative and summative assessment is performed in compliance with "TPU Regulations for Formative and Summative Assessment" (rector`s order # 59/од dated as 25.07.2018).<br>The maximum mark for one discipline (module) for one semester is 100 points including:<br>– mastering the discipline content (exam type – pass/fail exam; graded credit test); evaluated in formative assessment and summative assessment (interim attestation) is 100 points;<br>– mastering the discipline content (exam type – exam); evaluated in formative assessment is 80 points and summative assessment (interim attestation) is 20 points;<br>The maximum mark for the course final project (course final paper) for one semester (depending on what is applicable in compliance with curriculum) is 100 points including:<br>– marks for formative assessment is 40 points,<br>– marks for summative assessment (interim attestation, defense) |

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| | is 60 points.<br><br>Assessment measures for formative assessment designed for discipline (module) corresponding to learning performance and achievements are stated in the Attachment "Calendar Plan and Assessment Measures for the Course". |
| **Teaching Aids and Recourses** | Compulsory Readings:<br><br>[1] Pasko, O. A. (2017) *Recommended as an educational and methodological manual by the Editorial and Publishing Council of Tomsk Polytechnic University*. Engineering and Technical Sciences. Access Scheme: https://e.lanbook.com/book/106748 (content)<br>[2] Koptzeva, N. P. (2008). *Theory and practice of the innovative educational program on the aesthetic discipline cycle at the Siberian Federal University*.<br>[3] Herr, K., Anderson, G. L. (2014). *The action research dissertation: A guide for students and faculty*. Sage publications.<br>[4] Tyurin, Y. I. (2007) *Hydrogen power engineering, renewable energy resources and energy saving*. Tomsk Polytechnic Annual Journal: / Tomsk Polytechnic University (TPU), Alumni Association. Access Scheme: http://www.lib.tpu.ru/fulltext/v/Tomsk_polytechnic/2007/N13a4.pdf<br><br>Further Readings:<br><br>Wisker, G. (2017*). The postgraduate research handbook: Succeed with your MA, MPhil, EdD and PhD*. Bloomsbury Publishing.<br><br>https://www.sciencedirect.com/<br><br>https://www.springer.com/gp |
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