Appendix 1

Ministry of Science and Higher Education of the Russian Federation
NATIONAL RESEARCH
TOMSK STATE UNIVERSITY (NR TSU)

Institute of Applied Mathematics and Computer Science

APPROVE:
Director
_____A. V. Zamyatin

Evaluation materials of the current control and intermediate certification in the discipline

(Evaluation tools by discipline)

Data Science for Industrial Data Analytics

in the major of training

01.04.02 Applied mathematics and informatics

Orientation (profile) of training:

Big Data and Data Science

Tomsk – 2025

ET was implemented:
Assistant of the Department
of Theoretical Foundations of Informatics — D.A. Murzagulov

Reviewer:
Dr. tech. sciences, professor,
Head of the Department
of Theoretical Foundations of Informatics — A.V. Zamyatin

Evaluation tools were approved at a meeting of the educational and methodological commission of the Institute of Applied Mathematics and Computer Science (EMC IAMCS).

Protocol dated 22.05.2025 № 1

Chairman of the EMC IAMCS,
Dr. tech. Sciences, Professor — S.P. Sushchenko

Evaluation tools (ET) are an element of the system for assessing the formation of competencies among students in general or at a certain stage of its formation.

The ET is developed in accordance with the work program (WP) of the discipline.

1. Competencies and training outcomes, obtained upon the discipline mastery

Competencies	**Competence indicator**	**Code and name of planned training outcomes that characterize the stages of competency formation**	**Criteria for evaluating training outcomes**			
			Excellent	Good	Satisfactory	Unsatisfactory
PC-5. Able to choose methods, draw up terms of reference and develop algorithms for solving problems of industrial data analysis	IPK-5.1 Uses modern information processing technologies, computer technology in solving problems of industrial data analysis. IPK-5.2 Knows how to collect industrial data, knows the specifics of such data IPK-5.3 Draws up the terms of reference for the task of the professional area.	OP-5.1.1 Be able to apply libraries, data analysis frameworks in industrial systems. OP-5.2.1: Be familiar with existing methods and approaches for preprocessing process data. OP-5.2.2 Be able to apply existing data mining methods, reasonably adapting and modifying them taking into account the characteristics of the problem of the subject area. OP-5.3.1: Know the basic concepts and concepts of Industry 4.0, key technologies and their application aspects. OP-5.3.2: Know the classification of analytical tasks in industry, types of data and their sources. OP-5.3.3: Be able to formulate production objectives in terms of data analysis.	Demonstration of a high level of skills in the use of industrial data analysis tools. Demonstration of a high level of knowledge of approaches and methods of data analysis, the ability to comprehend information and draw reasonable conclusions from the literature.	In general, successful, but containing some gaps in knowledge of analysis tools. In general, successful, but containing some gaps in knowledge and possession of approaches and methods of data analysis.	Fragmentary, incomplete knowledge without gross errors in the use of analysis tools. Fragmentary, incomplete knowledge of approaches and methods of data analysis. Fragmented, incomplete knowledge of technologies in Industry 4.0	Does not have a clear understanding of the material being studied, makes gross mistakes when using research methods related to the analysis of industrial data.

2. Stages of competency formation and types of evaluation tools

№	Stages of competency formation (discipline sections)	Code and name of training outcomes	Type of evaluation tool (tests, assignments, cases, questions, etc.)
1.	Section 1: Industry Fundamentals 4.0	OP-5.3.1, OP-5.2.2, OP-5.3.3	Self-study Questions
2.	Section 2 Industrial Data Analysis	OP-5.1.1, OP-5.2.1, OP-5.2.2	Implementation of practical work

3. Typical control tasks or other materials necessary for the assessment of educational training outcomes

3.1. Typical tasks for conducting ongoing monitoring of progress in the discipline:

Current control is carried out on the basis of checking practical tasks for the course.

Practical work №1. Individual task on the topic “Signal pre-processing: cleaning, integration, transformation”.

Practical work №2. Individual task on the topic "Formation of informative features for technological signals".

Practical work №3. Individual task on the topic "Classification of technological signals".

Practical work No. 4. Individual task on the topic "Development of an anomaly detection algorithm in technological signals".

3.2. Typical tasks for conducting intermediate certification in the discipline.

Questions on theoretical material submitted for the exam:

1. What does Industry 4.0 mean? List the main technologies and their purpose.
2. Definition of digital transformation. What role does TF play in Industry 4.0?
3. Digital twins. What are the main functions of the CD?
4. Internet of things. Definition, functions, scope.
5. The role of machine learning in Industry 4.0? Application examples.
6. What is predictive analytics? What are the benefits of using predictive analytics for manufacturing? What tasks are predictive analytics systems aimed at solving?
7. Features of the implementation of predictive analytics in industrial enterprises? What are the objects of research, what is the peculiarity of industrial data? Industry data source?
8. Processing of technological signals. Main tasks and methods.
9. The problem of detecting anomalies in technological signals. The concept of the term anomaly? What is the difficulty in identifying anomalies? Types of anomalies?
10. Overview of the OneClassSvm algorithm.
11. Overview of the IsolationForest algorithm.
12. Overview of the Local Outlier Factor algorithm.
13. Overview of RNN in the problem of anomaly detection.
14. Overview of SNS in the problem of anomaly detection.
15. Overview of the DBScan algorithm in the problem of anomaly detection.

4. Methodological materials that determine the procedures for evaluating training outcomes

4.1. Methodological materials for assessing the current control of progress in the discipline.

The course "Industrial Data Analytics" uses a point-rating system for assessing knowledge. The maximum amount of points for the discipline is 100 points and is formed as follows: 80 points based on the results of the current certification and 20 points based on the results of the intermediate certification. The final grade for the discipline is the sum of the points obtained as a result of the current control and intermediate certification. The current certification includes the results of 4 practical work, for each practical work you can get up to 20 points.

4.2. Methodological materials for conducting intermediate certification in the discipline.

Criteria for the formation of an assessment during an intermediate control

Number of points	**The result demonstrated by the student**
16-20	It is exhibited to a student who knows the material well, correctly and, in essence, expounds it, who knows how to apply the knowledge gained in practice, who is able to independently make and justify decisions, and evaluate their effectiveness.
15-18	Exhibited to a student who knows the material well, correctly and, in essence, expounding it, able to apply the knowledge gained in practice, but allowing uncritical inaccuracies in the answer
10-15	It is exhibited to a student who has shown a fragmented, disparate nature of knowledge, who does not formulate the basic concepts accurately enough.
>10	Exhibited to a student who does not know most of the main content of the discipline, makes gross errors in the formulation of the basic concepts of the discipline

Correspondence of the rating score on a hundred-point scale:

0-60 points - "failed";

56-100 points - "test".