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Методичні вказівки з англійської мови за професійним спрямуванням для магістрів спеціальності Залізничний транспорт

ENGLISH FOR RAILWAY ENGINEERS

English learner guide for Master's Students specialty Railway Transport

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Unit 1. Lexical, Stylistic, and Grammatical Characteristics of English Scientific and Professional Texts

English scientific and professional writing possesses a range of specific features that distinguish it from literary or journalistic discourse.

Lexical and stylistic features. Such texts make frequent use of ***terminology*** — words with precise and unambiguous meaning within a particular discipline. ***Internationalisms***, such as *atom, system, method*, play a significant role, since they are recognizable across many languages and thus enhance mutual understanding among specialists worldwide. Scientific texts also rely heavily on ***symbols, abbreviations, and notations*** (*DNA, kg, %, AI*), which contribute to accuracy and brevity.

Grammatical characteristics. Passive constructions (*It is assumed that…*) are widely employed in scientific English, enabling authors to present findings objectively and avoid emphasizing the researcher. ***Nominalization***, i.e. converting verbs into nouns (*analysis, development*), is another common feature. Sentences tend to be complex, often containing subordinate clauses, while the text as a whole is organized logically and coherently.

The concept of equivalence. When translating, it is essential to render not just the literal wording but the precise scientific equivalent of a term. Direct borrowing or calquing is not always suitable, as various scientific traditions may rely on different conceptual approaches.

Machine translation limitations. While modern systems can provide the general sense of a passage, they often struggle with accurate terminology and stylistic nuance. For this reason, machine translation should be viewed only as a supporting tool in scientific contexts.

Methods of building a glossary. Building a glossary involves identifying key terms, collecting them from multiple reliable sources, recording their definitions in both English and the target language, and including examples of use. Such a glossary assists in accurate translation and helps learners acquire professional vocabulary.

In sum, English scientific and professional texts are marked by terminological accuracy, logical organization, and standardized linguistic means. To comprehend and translate them effectively, one must understand their lexical and grammatical features and be able to work systematically with terminology and glossaries.

ex.1 Read the text paying attention to ***lexical, stylistic and grammatical features of English scientific texts.***

Suspended monorail system dynamics: fundamental and practice

The suspended monorail system (SMS) has a development history of over a century to date and has been successfully applied in Germany, Japan, and China. However, it is a special type of train–bridge system, exhibiting significantly different mechanical mechanisms and dynamics issues compared with those found in traditional railway systems. So far, plenty of theoretical and experimental research on dynamics of the SMS has been carried out. The following concluding remarks are given:

1. ***The development of the train–bridge dynamics model of the SMS.*** The dynamics model of a suspended monorail vehicle has evolved from a simple pendulum model to a multi-rigid-body system dynamics model that considers complex motion relationships among various vehicle components. The multi-rigid-body dynamics models of the SMS vehicle can effectively simulate the dynamic behavior and interactive relationships of key components in the system. The finite element method has been widely used to establish the refined dynamics model of the SMS bridge, which can accurately simulate the spatial dynamic behavior of the thin-walled steel bridge. In addition, to effectively model the wheel–track dynamic interaction, a point contact tyre model and a patch-contact tyre model have been proposed successively. Compared with the earlier point contact tyre model, the

recently developed patch-contact tyre model can more accurately reflect the wheel–track contact behavior, which makes the train–bridge dynamics analysis more practical and more convincing, especially under short-wavelength track irregularity excitation.

2. ***The mechanical mechanism and critical dynamics issues of the SMS***. Suspended monorail train and bridge are coupled through the driving tyre–track relationship and the guiding tyre–track relationship. Under actual operation conditions, the driving tyre force and the guiding tyre force are sequentially transmitted to the bogie frame, bolster, center pin, suspended device, and car body, causing the vibrations of these components of the vehicle system. Meanwhile, the driving tyre force and guiding tyre force would, respectively, act on the driving track and guiding track, resulting in significant vibration and deformation of the bridge. Existing studies have found that the sway of the suspended vehicle is a prominent dynamics problem of the SMS, particularly when vehicles run through curved lines or in wind environments. Besides, the damage of key components of the SMS easily occurs under long-term train–bridge interaction, such as the wear of the rubber tyres and the breakage of the connecting plates between adjacent beams.

3. ***The dynamics features of the SMS train under crosswinds.*** The aerodynamic characteristics of an SMS can be well illustrated using computational fluid dynamics (CFD) technology and wind tunnel test method, and the CFD model should be validated using the results of the wind tunnel tests. With the support of relevant theories in wind engineering, the aerodynamic forces acting on train and bridge under crosswinds can be obtained accurately. For complex turbulent wind environments, the aerodynamic admittance function should be considered when calculating the unsteady aerodynamic force acting on the train–bridge system, and accurate modeling of wind loads is very important for simulating the running behavior of the vehicle under crosswinds. Unlike traditional railway vehicles, the SMS vehicle primarily exhibits significant lateral swaying motion under crosswinds, which should be effectively controlled to guarantee passenger riding comfort.

4. ***The field test and practice of the SMS in China.*** In recent years, the first full-scale test line of SMS in China has been built in Chengdu. A series of field

tests were conducted to evaluate the dynamic performance of the train–bridge system under various operation conditions and also to validate the reliability of the established train–bridge dynamics model of the SMS. Meanwhile, the reasonable values of crucial parameters of the system obtained by theoretical analysis were confirmed with the field test, which provides valuable guidance for the optimization design of the SMS. Based on the practice of Chengdu test line, several test and operation lines have been successively established.

ex.2 Identify 12 ***internationalisms*** in the text and explain why they function as such.

ex.3 Point out at least 5 stylistic markers of advanced scientific discourse. Transform one paragraph into ***neutral business English*** to observe stylistic shift.

ex.4 Find and analyze:

- 3 examples of ***complex sentences with embedded clauses***
- 3 examples of ***passive voice constructions***
- 3 examples of ***nominalizations***

ex.5 Select 5 terms (e.g., optimization design, dynamics model, interaction) and propose Ukrainian equivalents. Classify them as ***full equivalents, partial equivalents, or descriptive translations***.

ex.6 Compile a ***mini-glossary (15 terms)*** from the text, including:

- Term in English
- Definition in English
- Ukrainian equivalent

Unit 2. Genres of Scientific and Professional Literature and Their Linguistic Features

Scientific and professional literature includes a wide range of genres, each designed to fulfill particular functions within the academic and professional community.

Main types of scientific publications. These include ***research articles, reports, theses, abstracts, summaries, and conference papers***. Each genre has distinct linguistic characteristics. For instance, a ***scientific article*** generally consists of an introduction, methodology, results, and conclusion, employing precise terminology, passive constructions, and an objective tone. ***Conference papers and reports*** are usually more concise, emphasizing preliminary findings. ***Abstracts and summaries*** prioritize brevity and clarity, presenting only the essential points of the research. ***Theses and dissertations*** are more extensive, detailed, and systematically organized, whereas ***annotations*** serve as brief informative notes accompanying publications.

Types of scientific publications. Scientific works can be categorized into ***theoretical papers***, which develop concepts and frameworks; ***problem-focused studies***, which investigate and analyze specific research questions; ***discussion papers***, which examine different viewpoints; and ***polemical works***, which critique or challenge established perspectives. Each type demands specific linguistic strategies—polemical texts often employ evaluative language, while theoretical works tend to be highly abstract and conceptual.

Global scientific language. English has become the dominant language of science, prevailing in academic publishing, international conferences, and scientific communication. Using English allows research to reach a worldwide audience, promoting collaboration across nations and disciplines. At the same time, non-native speakers must conform to the conventions of academic English, including its specialized vocabulary, grammar, and style.

The genres of scientific and professional literature are varied, each with its own communicative purpose and linguistic traits. Mastery of these genres, their types, and the conventions of English as the global scientific language is crucial for effective participation in the international academic community.

ex.1 ***Read the text,*** identify and list all **g*enres of scientific-professional literatur*e** mentioned in the text.

Describe briefly the communicative purpose of each (e.g., research article, report, abstract).

Innovative methodology for longitudinal crack detection in prestressed concrete sleepers through modal identification and updating

The primary challenge in detecting longitudinal sleeper cracks induced by operational and regional conditions (e.g., bar corrosion) lies in the difficulty of precisely quantifying stiffness parameter changes. This challenge is compounded by the inability to visually assess critical crack characteristics like length and severity. This problem becomes especially acute when cracks initiate from the side of the rebar and extend outward, significantly affecting structural evaluation accuracy. To address this, we propose combining numerical modeling with experimental modal analysis to identify longitudinal cracks in in-situ PCSs, enabling early intervention to prevent severe structural damage and ensure track safety.

This study presents a finite element model updating method that enables the investigation and identification of structural damage by analyzing changes in modal parameters of the dominant modes in the concrete sleeper. A full-scale laboratory experiment was conducted on the PCS-B70 type with varying crack locations and lengths on polyurethane mats, serving as an alternative ballast layer, to verify the proposed method. To extract its dynamic properties, experimental modal analysis was employed to assess the health and monitoring of the PCSs. Artificial longitudinal cracking with lengths of 40, 80, and 120 cm was created at the top and bottom of the sleeper at various combination locations to simulate damage.

The first five modes were then used to update the FE models of the undamaged and damaged cases, showing that simulated damage reduced the stiffness of the sleeper in the corresponding regions. ***The most important results were summarized as follows:***

1. Compared to the damaged sleeper, the results show that the damage-caused changes are detectable in natural frequencies of lower bending modes (e.g.,

modes 1 to 3). However, rigid body and higher bending modes are not sensitive enough to identify a damaged sleeper.

2. The modal analysis results for longitudinal cracked sleepers, up to 80 cm in top location, show that the difference between the obtained natural frequencies was relatively small for all modes, with the most considerable difference percentages being under 5% compared to intact sleepers. These slight alterations cannot be considered reliable modal or acceptable indicators for failure identification in such long-bar corrosion.

3. Based on the obtained outputs, considering common FE methods in longitudinal cracked sleeper assessments may introduce an error of up to 30%. This level of uncertainty can significantly impact decisions related to maintenance and repair, posing a challenge and elevating the project's operational risk.

4. The proposed damage detection methodology and updated model outputs for undamaged PCS reveals an increase of approximately 20% in the elasticity modulus of the PCS and the elastic mat compared to the initially measured values.

5. Based on the outputs, the location and extent of cracking in concrete sleepers have a significant impact on dynamic modal outcomes, followed by the softening phenomenon. The most considerable percentage reduction in natural frequency in the first bending mode for a 120 cm long, longitudinally damaged sleeper with two top and bottom locations on both sides is about 25% and 20%, respectively, compared to the top and top-bottom position of one side with extending bar corrosion in sleepers.

ex.2 Select two genres (e.g., article, abstract) and list their ***typical linguistic features*** (style, grammar, vocabulary).

Rewrite one passage of the text in the style of an ***abstract*** (3–4 sentences, condensed, impersonal).

ex. 3 Reflect: How does the ***genre*** (article, report, thesis, polemical essay) influence the ***style, terminology, and structure*** of scientific writing in Railway Engineering?

ex. 4 Match the examples from the text with types of ***scientific publication****:*

- *methodology*
- *percentage reduction*
- *bottom locations*
- *challenge*
- *structural damage*

Unit 3. Searching, Reading, and Processing Information in the Professional and Scientific Sphere

In modern scientific and professional work, the capacity to locate, interpret, and analyze information is a fundamental competence for researchers and specialists alike.

Types of information. Several types can be identified: ***main information***, which delivers the central message of a text; ***additional information***, which adds depth or support; ***explanatory information***, which defines or clarifies concepts; ***argumentative information***, which supplies evidence; ***illustrative*** information, such as examples or data; and ***discussion-oriented*** information, which reflects differing perspectives. Recognizing these categories enables a more accurate understanding of written material.

Information search and selection. Modern researchers depend on electronic databases, search engines, and academic libraries. Useful strategies include choosing effective keywords, applying Boolean logic, and refining searches by time frame, subject, or author. Equally important is the critical evaluation of sources to confirm their credibility and relevance.

Types of reading. The choice of reading technique depends on purpose: ***skimming (overview reading), scanning(search reading)***, ***extensive reading*** for broad comprehension, and ***intensive reading*** for in-depth analysis of content, style, and reasoning.

Text organization and markers. Scientific texts usually follow a structured format, including introduction, methodology, results, and conclusion. ***Signal words*** such as *firstly, therefore, however,* and *in conclusion* serve as markers that highlight logical links and guide the reader through the argument.

Working with foreign-language texts. This process involves ***analyzing structure***, ***extracting main ideas, drawing conclusions, and systematizing material***. It may also include comparing sources and compiling glossaries of specialized terms.

In sum, the ability to search, read, and process academic information is demanding but indispensable. It requires not only digital tools but also critical thinking, language skills, and the ability to organize knowledge effectively for research and professional tasks.

ex. 1 ***Read the text and identify****:*

- basic information
- additional information
- explanatory information
- argumentative information
- illustrative information

Key technologies of China high-speed comprehensive inspection train: CIT450

The second generation of China's high-speed comprehensive inspection train, CIT450 integrates eight sub-systems spanning track maintenance, power supply, and signalling. CIT450 can conduct in-service, in-condition state inspections at an unprecedented speed of 450 km/h, and it can simultaneously test and output over 100 railway infrastructure inspection parameters. ***The following key technological developments in CIT450 are summarised:***

- Addressing the previous CIT inefficiencies in railway system inspections, where each data type required dedicated personnel, the CIT450 features

a comprehensive control platform. This platform centralizes control over the train inspection systems, monitors system operational states, manages data collection and sharing, and facilitates train-to-ground wireless transmission interaction. This innovation significantly reduces the need for inspection operators and enhances the efficiency of comprehensive inspections.

- A high-precision time and space synchronization benchmark for the train inspection systems has been established by integrating GPS, PTP (Precision Time Protocol) time synchronization networks, and wheel speedometers on the bogies. Utilizing the IEEE1588v2 protocol, microsecond-level synchronization across all systems' main clocks is achieved. This precise synchronization allows for dynamic, online, and accurate association of multi-disciplinary inspection data, paving the way for advanced multi-source multimodal data associative analysis.
- The inspection equipment incorporates the following functions, including evaluation of 200-m long-wave and short-wave track geometry irregularities, catenary health status evaluation, and 5G for railway (5G-R) communication testing. Enhanced capabilities for detecting abnormalities in the train operating environment are provided through machine vision technology.
- The CIT450 processes various inspection data with machine learning. This includes automatic filtering of abnormal interference data, precise identification of catenary poles, recognition of foreign objects in the train operating environment, detection of damaged fences, and automatic association and alignment of multi-disciplinary inspection data.

ex. 2 List ***the strategies for finding information*** mentioned in the text. Suggest ***two additional strategies*** researchers might use.

ex.3

- Outline ***the structure of the*** text in bullet points.
- Extract ***three main ideas***.
- Formulate ***a concise conclusion*** in your own words.

- Suggest ***how the information could be systematized in a glossary or research database.***

ex. 4 Match each ***type of reading*** with its ***purpose***:

1. Skimming
2. Scanning
3. General reading
4. Close reading

a) Getting an overview of the text's relevance

b) Searching for a specific term or number

c) Understanding the main arguments

d) Detailed analysis of methodology

Unit 4. Typical Functional Structures of Scientific and Professional English

Scientific and professional English is characterized by a high level of standardization. It employs established functional structures designed to maintain clarity, accuracy, and logical flow of information.

System and purpose of functional structures. These are conventional linguistic patterns used to fulfill specific communicative purposes. For instance, in research writing, authors follow recognizable structures: ***to introduce a topic*** (*The purpose of this paper is…*), ***to describe methods*** (*The experiment was carried out using…*), ***to present results*** (*The data show that…*), and ***to draw conclusions*** (*It may be concluded that…*). Their function is to create uniformity in scientific communication, thereby making texts accessible and comprehensible across different disciplines and cultural contexts.

Speech clichés and patterns. Functional cliches, or ***language templates***, are widely used to save effort and eliminate ambiguity. Examples include:

- *X is defined as…* ***(for definitions)***
- *However, in contrast, on the other hand…* ***(for highlighting contrasts)***
- *This indicates that…, It is important to note that…* ***(for argumentation)***
- *Firstly, secondly, finally, in conclusion…* ***(for structuring discourse)***

Far from weakening style, these standard expressions are valuable tools in scientific writing, as they guide the reader through reasoning and signal the role of each section of the text.

Working with clichés and patterns. For students and professionals, it is essential to learn, memorize, and apply such structures. A practical method is to build ***collections of phrases grouped by communicative purpose***—such as those for introducing ideas, showing contrast, summarizing, or hypothesizing. Regular practice in writing and speaking promotes fluency in professional communication.

In sum, functional structures in scientific English act as a system that guarantees clarity, precision, and consistency in academic texts. Mastery of such patterns enables researchers to communicate their ideas effectively while participating confidently in the international scientific community.

ex.1 ***Read the text and Identify typical functional structures in it.***

- Find examples of:

a) ***Generalizations*** (e.g., "It is generally assumed that…")

b) ***Emphasis structures*** (e.g., "It should be emphasized that…")

c) ***Evidence presentation*** (e.g., "It has been demonstrated that…")

d) ***Conclusions*** (e.g., "In conclusion, it can be stated that…")

Experimental and theoretical study of the smoke back-layering length in a tunnel with cross-passage: effects of longitudinal fire source locations

A series of burning tests were performed in a longitudinally ventilated tunnel with a cross-passage to examine the smoke backflow behavior. The influence of the longitudinal fire source location on smoke backflow dynamics was investigated. Further analysis was conducted to determine the smoke back-layering length. ***The primary conclusions are as follows:***

- The length of smoke back-layering increases as the heat release rate rises, attributed to the elevated static pressure of smoke backflow layering. The length of smoke back-layering diminishes as the longitudinal airflow velocity increases.
- The behavior of smoke backflow for the fire source located at the upstream resembles a fire in a single-hole tunnel. As the fire source relocates downstream, the length of smoke back-layering progressively increases. As the longitudinal wind speed increases, the variance between fire source positioned at the bifurcation point and downstream progressively diminishes. When the ventilation capacity is limited, the smoke diversion effect predominantly influences the length of smoke back-layering in the main tunnel. When the ventilation capacity is substantial, the diversion of airflow is the primary factor influencing the length of smoke back-layering in the main tunnel.
- A dimensionless fire source location D^* was introduced to quantify the smoke backflow behavior, and the dimensionless smoke back-layering length model was formulated in a tunnel with cross-passage by analyzing longitudinal fire source positions. The dimensionless smoke back-layering length is positively connected with Q raised to the 17/18 power and inversely correlated with V raised to the 5/2 power.

In this work, however, the heat release rates ranged from 5.03 to 15.09 kW, equivalent to a full-scale tunnel range of 1.59 to 4.77 MW. The smoke back-layering length with weak plume was mainly investigated in this work. Further work will be conducted to study the smoke back-layering length with strong plume in tunnels with cross-passage. On the other hand, the angle of the branch tunnel may have an impact on

the smoke backflow behavior, which will be in progress to investigate in the further studies.

ex. 2 ***Explain the communicative purpose of each structure:***

- Generalizations
- Emphasis
- Evidence citation
- Conclusion markers

ex. 3 ***Work with clichés and patterns***

- Extract 5 common ***scientific clichés*** from the text (e.g., *The primary conclusions are as follows*).
- Rewrite two of them in simpler English without changing the meaning.

ex. 4 Write 3–4 sentences (mini-abstract) on any ***railway issue*** (e.g., safety, maintenance, high-speed transport) using at least ***three functional clichés/patterns*** from the list:

- It is generally assumed that…
- It should be emphasized that…
- It has been demonstrated that…
- In conclusion, it can be stated that…

Unit 5. Interpretation of Visual Aids Accompanying a Text

In academic and professional contexts, written work is frequently supported by ***visual aids*** such as tables, graphs, charts, diagrams, and figures. Being able to correctly interpret and describe these tools is a crucial competence for both students and researchers.

The role of visual aids. Visuals help to ***clarify, summarize, and illustrate*** information that might otherwise be difficult to present in words. For example, a table organizes numerical data for easier comparison, while a graph highlights trends and relationships more effectively than text. Diagrams and schematic images represent processes, mechanisms, or hierarchies, making abstract ideas more accessible.

Describing visual aids. Accurate language use is essential when referring to visual elements. Common expressions include:

- ***Tables*****:** "Table 1 presents data on…," "As shown in the table…"
- ***Graphs*****:** "The graph demonstrates an upward trend in…," "The line indicates a steady decrease…"
- ***Figures/diagrams*****:** "Figure 2 illustrates the structure of…," "The diagram shows the process of…"

Clear references like these guide the reader in connecting the description to the appropriate visual.

Summarizing with visuals. Graphical presentation is often used ***to highlight the key results of research.*** Instead of detailing every value, visuals emphasize main patterns, for example: *"The results indicate a positive correlation between X and Y,"* or *"The highest measurements occur in…"* Such formulations draw attention to central findings.

Integration into text. Visuals should always be accompanied by explanatory text that clarifies both what they depict and how they relate to the study. Effective descriptions ***combine explanation with interpretation***, linking the visual directly to the research objectives.

In sum, the skill of analyzing and describing visual aids is vital in scientific writing. Tables, graphs, and diagrams not only make data clearer and more concise but also strengthen arguments. Proficiency in this area enables researchers to present their work with greater clarity and persuasive power.

ex. 1 Read the text and Identify the types of visual aids mentioned in it (e.g., line graph, bar chart, heatmap, table, schematic diagram). For each type, describe its ***purpose*** and what kind of information it conveys.

Study on air quality improvement in train compartments by coordinated exhaust of multiple air outlets

In this study, a full-scale computational model of a train compartment was established. The study investigated the impact of combining top exhaust and bottom exhaust on ventilation energy consumption, passenger thermal comfort and the dispersion characteristics of respiratory pollutants inside the passenger compartment of a high-speed train. Multiple evaluation indicators were used to assess the airflow organization within the compartment under summer and winter conditions. ***The research conclusions are as follows:***

1. Under the combined influence of the supply airflow, thermal plume and negative pressure at the exhaust outlet, two distinct vortices are formed on both sides of the compartment. With the increase of the airflow rate from the top exhaust outlet, the air velocity in the passenger area slightly decreases, while the vertical temperature difference in the passenger area under the winter condition may increase.
2. With the increase of the exhaust airflow rate from the top exhaust outlet, the average temperature inside the train compartment decreases. Therefore, it is conducive to improving the energy utilization coefficient under the summer condition, while the opposite is true for the winter condition.
3. In terms of thermal comfort, combining top exhaust with bottom exhaust can effectively improve the air velocity index and the temperature difference index. The DR and PD indices in the occupied zone meet the requirements of class A in the ISO 7730 standard. Moreover, the air velocity index and temperature difference index perform better under summer conditions, while the ADPI index performs better under winter conditions.
4. In terms of air quality, as the exhaust airflow rate from the top exhaust outlet increases, the concentration of pollutants inside the train compartment decreases, while the diffusion distance of pollutants along the length of the compartment increases. After combining these two indicators, it is found that increasing the top exhaust tends to worsen the spread of pollutants, while this effect is somewhat improved under winter conditions.

The research results indicate that coordinated exhaust through multiple air outlets holds great potential for improving the ventilation performance of trains. In daily operation, full top exhaust can be prioritized under summer conditions, while a 50% coordinated exhaust can be prioritized under winter conditions. When it is necessary to control the spread of pollutants, the exhaust mode can be adjusted according to the infectivity of the virus. For example, an exhaust mode that minimizes the spread range can be chosen while controlling the probability of infection. Additionally, the specific values of each evaluation index may be affected by the train model and other designs. Specific verification is required in practical engineering applications. The current research conclusions can provide references for the ventilation design of high-speed trains.

ex.2 Summarize in one paragraph how visual tools help in ***comparing experimental results and communicating findings.***

ex. 3 Discuss the ***advantages and limitations of using visual aids*** in Railway Engineering Science publications.

ex. 4 Match each ***functional structure/cliché*** with its ***purpose:***

1. *It has been demonstrated that…*
2. *From a research perspective…*
3. *In conclusion, it can be stated that…*
4. *It should be emphasized that…*

a) Present the researcher's final summary

b) Highlight important points

c) Introduce the researcher's viewpoint

d) Provide evidence from studies or experiments

ex. 5

- Give one example of ***a scientific cliché*** used to summarize findings.

- Suggest one strategy for improving ***clarity when combining text and visuals*** in a scientific article

Unit 6. Scientific Written Communication

Scientific writing plays a crucial role in academic and professional fields, as it ensures that research findings are conveyed with clarity, accuracy, and logical order.

Structure of a scientific text. Most research papers follow a well-defined framework consisting of an ***introduction, a main body, and a conclusion***. ***The introduction*** defines the topic, research problem, and purpose. ***The main body*** provides methods, evidence, and reasoning, while ***the conclusion*** summarizes the results and emphasizes their relevance. This structure guarantees consistency and logical flow.

Techniques of scientific presentation. Information in scholarly writing can be presented in three main forms:

- ***Description*** – giving objective facts about objects, processes, or phenomena.
- ***Narration*** – recounting events or experiments in chronological sequence.
- ***Reasoning (argumentation)*** – evaluating, comparing, and justifying ideas or hypotheses.

In practice, these techniques are often combined within one paper.

Semantic models in research texts. Scientific communication frequently employs standard logical patterns such as problem–solution, cause–effect, or comparison–contrast. Examples include: *This paper addresses the issue of…*, *The findings demonstrate that X leads to Y*, *Compared with previous studies…*. Such patterns guide the logical development of arguments.

Formulating a research title. An effective title is ***precise, concise, and informative,*** clearly reflecting the subject and scope of the study—for instance, *"The Role of Renewable Energy in Promoting Urban Sustainability."* Vague or overly broad titles should be avoided.

Functional structures in academic English. Scientific English relies on standard ***functional patterns and clichés***, such as *The aim of this study is…, The results indicate…, It can be concluded that….* These structures help to organize text, highlight logical connections, and make the message accessible to an international audience.

In summary, successful scientific communication relies on a well-structured format, appropriate methods of presenting information, and the use of conventional language patterns. Mastery of these elements enables researchers to express their ideas effectively, persuasively, and in line with global academic standards.

ex. 1 ***Read the text, identify*** three parts of the text ***(introduction, main body, conclusion).*** Explain their communicative purpose.

Implementation of an AI-based predictive structural health monitoring strategy for bonded insulated rail joints using digital twins under varied bolt conditions

This research explored an innovative approach that uses the responses of a digital twin (DT) simulating the behaviour of a bonded IRJ to train AI classifiers capable of predicting the state of the joint when a pair of wheels passes. As monitoring plays an increasingly important role in the effective, sustainable and efficient operation of modern railway infrastructure, the proposed methodology represents the starting point for a digital revolution in the sector. In fact, the use of DTs will allow the behaviour of different parts of the infrastructure to be investigated more quickly, safely and economically, highlighting anomalies and fault conditions that would otherwise be difficult to observe. The latest AI tools will use the data collected in this way to train accurate predictive models.

Specifically, the DT of the IRJ, implemented using the FE software Abaqus/CAE, allowed the joint behaviour to be simulated during wheel passage for different bolt preload configurations, categorised into 4 joint structural health classes, labelled “safe”, “warning”, “risk” and “fault”, ranging from the normal condition of correct preload to situations of loose or even missing bolts. The features studied for training and testing the predictive model or for classifying new data are the gap value and the vertical displacement of the joint, collected in correspondence of 4 wheel positions, for which these values tend to increase significantly as the bolt preload is reduced.

Once collected and appropriately pre-processed, the DT simulation data are loaded into the Classification Learner application available in MATLAB®. Two decision trees of different complexity, i.e. a coarse tree and a medium tree, are trained and tested for 5 classifiers using different numbers and types of significant features. Their classification effectiveness was assessed using accuracy, recall, precision and F1-score indicators, and by plotting the confusion matrix and ROC curve. At the end of the testing phase, we found that the classifier based on the gap value performed slightly better than those based on the vertical displacement. Furthermore, the classifiers that guarantee the best performance are those that include the residual displacement as a significant feature. They demonstrated an overall accuracy of 95%, with higher F1-score for the most critical classes, i.e. “risk” and “fault”, proving to be a valid tool for predictive monitoring. Finally, two of the trained classifiers were used to predict IRJ conditions based on experimental data. Both models using gap value information, with or without residual displacement, confirmed their high accuracy.

Although the proposed approach is still a first step compared to the potential achievable with the latest technologies, the good performances obtained confirm the importance of researching new PdM strategies based on the synergy between DTs and AI. In fact, the digitisation process of SHM for railway infrastructure is currently one of the most important technological and scientific challenges, capable of bringing together an ever-increasing number of different stakeholders, from universities to private groups, as confirmed by the success of the Italian project MOST—Centro Nazionale per la Mobilità Sostenibile —Spoke 4 Railway Transport—for efficient and effective rail transport, in

which several academic and industrial partners are promoting the digitisation of railways to improve their sustainability, maintenance and management efficiency. MOST is an implementing project of the National Recovery and Resilience Plan (NRRP) as part of the Next Generation EU (NGEU) programme.

The flexibility of the approach used will allow it to be safely extended to the rapidly and continuously evolving SHM context. Furthermore, our research group agrees on the multiple development possibilities of the proposed model. In fact, we are convinced of the usefulness of training a classifier to provide information on the exact combination of loose or missing bolts, of studying and predicting the behaviour of the IRJ when the elastic foundation of the sleepers in the vicinity of the joint is varied, and of comparing the decision trees used for this task with other ML algorithms. By deepening and developing new and advanced versions of the model, we will investigate the dynamic effects due to different train speeds, i.e. the behaviour of the IRJ under different environmental conditions or trains with different loads, as well as methods capable of using the monitoring data in its entirety. We will then be able to instrument a bonded IRJ to carry out a large experimental campaign useful to consolidate the training of the predictive model, combining new data with that of the DT, and finally test the classifier directly in the field.

ex. 2 Find examples of ***description***, ***narration***, *and* ***argumentation*** in the text.

ex. 3 Define the ***structural-semantic model*** used in the main body. Recast it into another model (e.g., cause–effect–recommendation).

ex. 4 Suggest 2 alternative ***academic titles*** for the text.

ex. 5

- Identify 3 ***functional structures*** used in the text.
- Explain their ***communicative purpose***.
- Rewrite each one with an equivalent ***academic cliché***.

ex. 6 Write a 4–5 sentence abstract of the text ***using academic clichés*** such as: *The article addresses… The aim of the study is… It has been shown that… The findings suggest that…*

ex. 7 Match the ***functional structure*** with its ***purpose***:

1. *It has been demonstrated that…*
2. *It should be noted that…*
3. *From a structural perspective…*
4. *In conclusion, it can be stated that…*

a) Highlight importance

b) Frame analytical viewpoint

c) Summarize findings

d) Present empirical evidence

Unit 7. Abstract Writing

One of the important skills in academic communication is the ability to ***write summaries or abstracts*** – in Ukrainian, *реферат*. This skill is widely used in research, education, and professional practice.

The purpose and structure of an abstract. The main purpose of a summary or abstract is to ***present the essential content of a larger text in a concise form***. It allows readers to understand the main ideas, results, and conclusions without reading the entire work. A typical structure of an abstract includes:

- ***Introduction*** – the topic and aim of the research;
- ***Main body*** – key arguments, findings, or facts;

- ***Conclusion*** – the general result or significance of the study.

Types of abstracts. We can distinguish several kinds:

- ***Indicative abstracts****,* which briefly outline the topic and purpose without giving details;
- ***Informative abstracts***, which summarize methods, results, and conclusions of the research;
- ***Combined abstracts****,* which include both general description and detailed information. In academic practice, informative abstracts are most common because they provide enough data for evaluation of the research.

Linguistic features of abstracts. Abstracts are characterized by ***conciseness, clarity, and objectivity***. The vocabulary is highly ***terminological*** and free from emotional or figurative language. Typical grammatical features include the ***use of the Present Simple and Past Simple****,* as well as the ***passive voice*** (*It was found that…, The study is devoted to…*). Standard functional clichés are often used: *The article deals with…, The paper focuses on…, The results demonstrate….* These patterns help maintain a formal academic style.

Abstract writing is an essential academic skill. A well-written abstract summarizes the key points of research, saves the reader's time, and ensures effective scientific communication. Mastery of structure, types, and linguistic features of abstracts is crucial for every student and researcher.

ex. 1 ***Read the text and identify*** which parts of the text correspond to:

1. Introduction (topic, problem statement)
2. Main findings (methods, results)
3. Conclusion (implications, recommendations)

Drive-by damage detection methodology for high-speed railway bridges using sparse autoencoders

The present work introduced a novel approach for HSR drive-by bridge damage detection utilizing adapted Mel-frequency damage-sensitive features in association with deep learning algorithms (sparse autoencoders) to produce a statistical distribution-based damage index. The suggested methodology for indirect SHM in the railway field uses vehicle responses from multiple instances of a service train crossing the target bridge, which were simulated using a 3D VTBI model implemented in Matlab®.

The trained SAE models can effectively and accurately represent the feature space related to vehicle responses for healthy conditions and generate reconstructed Log-Mel spectrogram with error distributions whose KL divergences display sensitivity to the damage in the bridge. Mel-spectrogram features, in turn, can convert the temporal representation of the vehicle acceleration signals into a comprehensive representation of frequency, time, and intensity (power) in higher dimensions. This characteristic renders Mel-frequency cepstral features very compatible with autoencoder architectures. The results indicate that the proposed approach provides a damage index that can successfully identify the presence of localized damage along the bridge span and at their ends. While the sensitivity to damage severity is evident, particularly for early-stage damages, regardless of train speed, sensor position, and environmental and operational variations such as track irregularities and artificial noise, further refinement is necessary to improve the precision in locating the damage and characterizing it. It can also distinguish its severity (mainly for early-stage damages), regardless of train speed, sensor position, and environmental and operational variations such as track irregularities and artificial noise.

Such results suggest the potential of applying Mel-frequency damage-sensitive features associated with machine learning algorithms in the drive-by assessment of high-speed railway bridges based on their existing conditions. ***Future work includes:***

- Improvements to the 3D VTBI model regarding the bridge subsystem.
- Improvements to the damage location methodology. Although the proposed damage index is successful in identifying the presence of damage in a

section of the bridge and distinguishing its severity, it may yield similar magnitudes for a high-severity damage scenario near the support and a lower-severity scenario closer to the midspan of the bridge. In addition, similar results may be observed at different but symmetrical locations.

- Evaluation of the strategy robustness when operational variations regarding vehicle property changes are considered.

- Investigations into improvements to the method arising from the use of autoencoder models with different architectures and the application of data fusion techniques, and, eventually, field tests to further validate of the applicability of the statistical distribution-based drive-by damage detection methodology. The use of real measurement data introduces the challenge of dealing with noise and other extraneous information that can obscure the features of interest critical for damage detection. Signal filtering, therefore, becomes a paramount component of the preprocessing stage in the application of the proposed methodology to real-world scenarios.

ex. 2 Based on the text, ***indicate*** which type of abstract is most suitable:

- Indicative (descriptive)
- Informative
- Critical

ex.3 Identify three ***typical linguistic features*** in the text suitable for abstracting, such as:

- Use of passive voice
- Present tense for generalizations
- Use of functional phrases (*It has been demonstrated that…*, *Recent studies show…*)

ex. 4 ***Write*** a 5–6 sentence abstract of the text including:

- Purpose of the study
- Methods/approach
- Main results
- Conclusion/implications

- ✓ Use ***academic-functional phrases suitable*** for abstracts***.***

  ex. 5

  - Explain why ***abstracting*** is essential in scientific communication.

  - Discuss which elements of the text are ***most important to include in an abstract*** and why.

Unit 8. Annotation and Writing of Theses

Annotation and thesis writing are important forms of scientific written communication. They help researchers present ideas in a concise and structured way, making scientific information more accessible.

The methodology of annotation. Annotation means providing a ***short description of a text*** that highlights its purpose, structure, and key content. Unlike a full summary, an annotation is usually very brief—often no more than a few sentences. The main steps of annotation include:

1. Identifying the ***topic and aim*** of the work;
2. Outlining its ***structure*** (introduction, main part, conclusion);
3. Pointing out the ***main results or arguments***. Annotations must be clear, factual, and objective, without personal opinion or unnecessary details.

Writing of theses. Theses, or conference abstracts, are a condensed form of a research paper presented at academic events. Their function is to ***communicate the essence of a study*** quickly and effectively. Theses usually include: the problem or research question, the purpose of the study, methodology, main findings, and conclusions.

Linguistic requirements for theses. Scientific theses must be written in ***formal, precise, and clear language***. The style is impersonal and objective, avoiding emotional or subjective expressions. Terminology should be used consistently. Typical linguistic features include the ***passive voice*** (*It was found that…*), ***short declarative sentences***, and

the use of ***functional clichés*** such as *The paper considers…, The research aims to…, The results show…*. Brevity is also crucial, as theses are usually limited in length.

Annotation and thesis writing are essential skills in academic communication. Annotations provide concise descriptions of texts, while theses summarize the main ideas of research for presentation. Both require clarity, objectivity, and adherence to the conventions of scientific language. Mastering these skills allows researchers to share their work effectively within the academic community.

Read the text and do the tasks below.

A simple method for automatic recreation of railway horizontal alignments

In this paper, a simple method for automatically recreating horizontal alignments of existing railway lines is proposed. On the basis of a previous geometrical model developed to easily obtain a continuous parametrization of the centerline of a horizontal alignment composed of tangents, circular curves, and clothoids, the formulation of two constrained optimization problems is defined. In both of them, the main objective is optimizing a recreated alignment by minimizing the distance from an existing one, but in the second one, an additional penalty function is included in order to force the solutions to adjust their geometrical parameters to some known values.

The method consists of two stages in which both optimization problems are solved consecutively by means of numerical techniques using the optimal solution of the first one as initial alignment for starting the resolution of the second one. However, if there is no information about the geometric parameters of the existing alignment, then, the first stage of the method can still be applied. After being tested with an academic example in order to assess its performance, the method was successfully applied to a railway line section located at Parga (Spain), proving to be a very useful tool for recovering the geometry of existing horizontal alignments. ***The main advantages of this simple method can be summarized as follows:***

- It is not necessary to conduct the identification stage in order to assign a potential geometrical element, avoiding all the inherent difficulties related to this task.
- The second stage allows to consider during the optimization process some available information about the geometry of the existing alignment.
- The whole horizontal alignment can be recreated automatically, instead of obtaining different separate parts that should be properly connected later.
- All the geometrical elements (tangents, circular curves, and transition curves) are optimized simultaneously, without any of them being predefined in advance.
- The definition of the optimization functions avoids the need of spending time on solving over and over the problem of computing the distance between a point and a clothoid curve.

On the contrary, the proposed method presents the following limitations and drawbacks that should be taken into account in further research in order to improve its performance or being able to apply it to other scenarios.

- Some difficulties during the generation process were observed in the recreation of the case study, owing to the different spatial distribution of the curves along the railway section. As it can be observed in Fig. 7, the distance between the vertices of the RHA is greater in the western zone than in the eastern zone. This fact, not considered at the moment, should be studied in order to improve the random generation of initial alignments.
- The mathematical model considers exclusively symmetrical clothoids (as mentioned in Sect. 2), being of great interest to implement in the future the possibility of considering non-symmetrical transition curves.
- The mathematical model considers only one combination of geometrical elements: tangent segments, joined by circular curves with symmetrical clothoids. It would be very useful to adapt the model to other combinations, such as compound curves, very common in older railway lines.

ex. 1

a) Read the text carefully. Identify the ***main idea*** in one sentence.

b) Highlight the ***key points*** that support the main idea.

- Examples: threats, measures, shared responsibility.

c) Write a ***brief annotation (50–70 words)*** summarizing the text.

ex. 2

a) Identify ***potential theses statements*** from the text.

b) Create ***3–5 concise thesis statements*** suitable for a scientific presentation or report.

ex. 3

a) Highlight ***formal and impersonal language*** in the text.

b) Identify ***linkers and connectors*** appropriate for abstracts or theses: *however, moreover, therefore, in addition, for example*.

c) Rewrite one of the thesis statements using ***formal academic phrasing***.

ex. 4

a) Using the text as a model, write a ***50–70 word annotation***.

b) Formulate ***3 concise thesis statements*** on another cybersecurity topic (e.g., ransomware, phishing, IoT security).

c) Ensure the annotation and theses use ***formal, concise, and impersonal language.***

Unit 9. Scientific Article

A scientific article is one of the most important forms of written academic communication. Its main function is to present research findings and make them available for discussion within the scientific community.

The structure of a scientific article is generally standardized and includes several key elements:

1. ***Title*** – should be clear, concise, and informative, reflecting the subject of the study.

2. ***Abstract and keywords*** – a brief summary of the article that outlines its purpose, methods, and results; keywords facilitate information retrieval.

3. ***Introduction*** – explains the relevance of the topic, defines the aim and objectives of the study, and identifies its subject and scope.

4. ***Literature review or theoretical background*** – shows what has already been done in the field and situates the research within existing knowledge.

5. ***Methodology*** – describes the research methods, procedures, or experiments applied.

6. ***Main body (results and discussion)*** – presents findings, interprets them, and compares them with previous studies.

7. ***Conclusion*** – provides a concise summary, highlights the significance of the results, and may suggest directions for further research.

8. ***References*** – a properly formatted list of sources used, following academic citation standards.

Linguistic requirements of a scientific article include:

- ***Objectivity and precision***: the language must be factual, avoiding emotional or subjective expressions.
- ***Use of terminology***: terms should be applied consistently and in their exact meaning.
- ***Formal academic style***: frequent use of passive voice (*It was found that…*), nominal phrases, and impersonal constructions.
- ***Logical coherence***: use of linking words and markers such as *firstly, however, therefore, in conclusion* to ensure clarity and flow.

- ***Conciseness and clarity***: sentences should be straightforward, avoiding redundancy and unnecessary complexity.

A scientific article is a structured and formalized genre of writing. Its success depends not only on the originality of the research but also on the clarity, objectivity, and precision of its language. Mastery of these requirements ensures that the article is accessible and valuable to the scientific community.

ex. 1 ***Read the text and answer the questions:***

1. Which element of a scientific article primarily ***justifies the research problem and formulates the research question****?*

   A. Abstract
   B. Introduction
   C. Literature Review
   D. Conclusion

2. Which of the following is ***not a linguistic requirement*** for scientific articles?

   A. Formal and precise language
   B. Correct use of technical terminology
   C. Use of colloquial expressions for engagement
   D. Cohesion and logical flow

Scientific Articles in Railway Engineering: Structure and Linguistic Standards

Writing scientific articles in railway engineering requires not only technical expertise but also adherence to specific structural and linguistic conventions that ensure clarity, precision, and academic integrity. The goal of a well-written article is to communicate research findings effectively to a professional audience, allowing others to understand, verify, and build upon the results. Therefore, mastering both the organization and language of scientific writing is essential for success in this field.

Structure of a Scientific Article

Most scientific papers in railway engineering follow the conventional IMRaD format: *Introduction, Methods, Results, and Discussion*. This standardized structure ensures logical flow and facilitates comprehension.

The ***Introduction*** sets the context of the study, identifies a gap in existing knowledge, and states the research objective or hypothesis. In railway engineering, it often includes background information on transportation systems, track design, vehicle dynamics, or infrastructure management. A concise literature review helps to demonstrate familiarity with prior studies and to justify the relevance of the current research.

The ***Methods*** section details the materials, tools, and procedures used to conduct the study. In engineering, this might involve describing computational models, simulation techniques, laboratory experiments, or field measurements. Precision and reproducibility are key: every step should be described sufficiently for another researcher to replicate the study.

The ***Results*** section presents the main findings objectively, using tables, graphs, and figures to illustrate performance metrics, model outputs, or experimental data. Descriptive clarity is crucial; interpretation should be reserved for the subsequent section.

The ***Discussion*** interprets the results in relation to existing research, highlighting their significance, limitations, and potential applications. For railway engineering, this could mean explaining how a new rail material improves durability or how an optimization algorithm enhances scheduling efficiency. The article usually ends with ***Conclusions*** summarizing the findings and suggesting directions for future work.

Linguistic Standards in Scientific Writing

Scientific writing in railway engineering demands formal, concise, and impersonal language. Authors should use the ***passive voice*** *and* ***third-person perspective*** to emphasize

the research rather than the researcher—for example, “The model was validated using experimental data” instead of “We validated the model.” However, modern academic style increasingly accepts moderate use of the first person (“We developed a new model”) when it improves readability.

Terminological precision is essential. Terms like “axle load,” “rolling contact fatigue,” or “track irregularity” must be used consistently and correctly, often following international standards such as EN or ISO. Acronyms should be defined at first use, and units should conform to the International System (SI).

Sentences should be clear and direct, avoiding unnecessary complexity. Cohesive devices such as *therefore, moreover, consequently,* and *in contrast* ensure logical connections between ideas. Paragraphs typically begin with a topic sentence that states the main point, followed by evidence or examples.

Ethical and Formatting Considerations

Ethical writing practices include accurate citation of sources, avoidance of plagiarism, and transparent reporting of data and methods. Most journals require adherence to specific formatting styles (e.g., IEEE, Elsevier, or Springer guidelines). Figures must be clear and properly captioned, while references should be comprehensive and up-to-date.

In conclusion*,* writing scientific articles in railway engineering involves balancing technical accuracy with linguistic precision. A well-structured, clearly written paper enhances the visibility and credibility of research, contributing to innovation and safety in railway systems worldwide. By following standardized structures and linguistic norms, engineers can communicate complex findings effectively and foster progress within the global scientific community.

ex. 2 Match each element of a scientific article ***with its function***:

Element ***Function***

1. Abstract	A. Reviews prior research and identifies gaps
2. Methodology	B. Summarizes the study in a concise form
3. Literature Review	C. Presents experimental procedures
4. Discussion	D. Interprets findings
5. Conclusion	E. Summarizes key findings

ex. 3 List ***four essential components*** that must appear in the methodology section of a railway engineering article.

ex. 4 Discuss one ***common mistake*** students make when writing scientific articles and how to avoid it.

ex. 5 Write a ***scientific abstract (80–120 words)*** for a railway engineering study using the guidelines from the text.

The abstract must:

- Include the research problem, methods, key findings, and conclusion
- Use formal and precise scientific language
- Apply railway engineering terminology correctly
- Be concise, self-contained, and coherent

Unit 10. Dialogic Speech on Professional Topics

In academic and professional communication, ***dialogic speech*** plays a crucial role, as it enables exchange of ideas, clarification, and constructive discussion.

Similarities and differences between oral and written forms of communication. Both oral and written communication serve to transmit professional knowledge. Oral communication, such as lectures, seminars, or discussions, is often more spontaneous, interactive, and emotionally colored, allowing immediate feedback. Written communication, on the other hand, is highly structured, standardized, and demands precision and logical completeness.

Dialogic vs. monologic speech in the professional sphere. Monologic speech includes presentations, lectures, or reports, where one speaker delivers information in a structured way. Dialogic speech refers to interactions such as discussions, debates, or consultations, which involve exchange, questioning, clarifying, and argumentation. In professional contexts, both are necessary, but dialogic speech develops critical thinking and collaboration skills.

Typical professional questions in dialogic speech may include:

- What is the main aim of your research?
- Which methods did you use and why?
- How do your findings compare with existing studies?
- What practical applications can your results have?
- What are the limitations of your work?

Discussion of main trends in the field usually involves analysis of recent publications, comparison of new technologies, and forecasting the future development of the discipline.

Discussion of a master's thesis focuses on the relevance of the topic, novelty of the research, methods applied, and the value of the obtained results.

Discussion of research results requires the ability to present data (orally or using visual aids such as graphs and tables), formulate clear conclusions, and respond to critical feedback from colleagues.

Independent work (practice): students are encouraged to practice formulating typical professional questions, which helps them improve their dialogic skills and prepares them for participation in real scientific communication.

ex. 1 ***Read the text and answer the questions:***

1. ***Monologic speech*** is best exemplified by:
   A. A team discussion on system vulnerabilities
   B. A lecture presenting research findings
   C. A Q&A session at a conference
   D. A collaborative problem-solving meeting

2. Why is formulating professional questions important in ***dialogic communication***?

A. To fill time during discussions

B. To ensure clarity, relevance, and productive exchanges

C. To make written reports longer

D. To avoid oral participation

Effective Professional Communication in Railway Engineering: Dialogue, Monologue, and Academic Discourse

Effective professional communication is a cornerstone of success in railway engineering, where precision, safety, and collaboration are paramount. Engineers and researchers in this field must be able to share technical information clearly, whether through reports, presentations, or discussions. Communication in railway engineering can take several forms, including dialogue, monologue, and academic discourse. Each serves a distinct function and requires specific linguistic and interpersonal skills to ensure clarity, efficiency, and professional credibility.

Dialogue in railway engineering typically occurs during meetings, team collaborations, and technical discussions. It is an interactive form of communication that involves exchanging ideas, clarifying data, and solving problems collectively. For instance, when engineers discuss railway track design or analyze system failures, they rely on dialogic communication to ensure that each team member's perspective is heard and understood. Effective dialogue requires active listening, professional vocabulary, and the ability to formulate precise questions and responses. It also demands emotional intelligence and respect for professional hierarchy and expertise. In railway projects, clear dialogic communication prevents misunderstandings that could lead to costly or unsafe engineering errors.

Monologue, on the other hand, is used when one individual conveys information to an audience without expecting immediate interaction. Common examples include technical lectures, presentations of research findings, and safety briefings. In railway engineering,

monologic communication is often used to deliver structured information about new technologies, maintenance procedures, or project updates. The effectiveness of monologic speech depends on clarity, logical organization, and the speaker's ability to engage listeners through visual aids, examples, and concise explanations. A successful lecture or presentation transforms complex engineering data into comprehensible, actionable knowledge for the audience.

Academic discourse represents the formal, written, and research-oriented side of professional communication. In railway engineering, it includes scientific articles, reports, technical papers, and theses. Academic writing requires objectivity, precision, and adherence to formal structure and referencing standards. Engineers use academic discourse to share innovations, document experimental results, and contribute to the body of knowledge in the field. Unlike everyday communication, academic discourse emphasizes evidence-based reasoning, impersonal style, and clarity of argument. It also helps establish professional credibility and promotes collaboration between institutions and researchers worldwide.

In conclusion, effective professional communication in railway engineering combines dialogic interaction, monologic delivery, and academic discourse. Mastering these forms enables engineers to collaborate efficiently, present ideas convincingly, and contribute to the advancement of the discipline. Strong communication skills not only enhance technical work but also ensure safety, innovation, and professional growth within the railway industry.

ex. 2 Match the type of speech ***with its description:***

Type of Speech	**Description**
1. Dialogic	A. Delivered by a single speaker to inform or persuade
2. Monologic	B. Interactive

exchange between two or more participants

ex. 3 List **two similarities** and **two differences** between oral and written communication in professional railway engineering contexts.

ex. 4 Identify **two linguistic strategies** used to ensure clarity in professional dialogic communication.

ex. 5 Explain how dialogic communication contributes to discussing master's theses or research results.

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Навчальне видання

Методичні вказівки
з англійської мови «Англійська мова для інженерів залізничної галузі»

для магістрів
спеціальності Залізничний транспорт

English learner guide
«English for railway engineers»
for Master's Students specialty Railway Transport

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