

**МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ  
НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ  
«ЗАПОРІЗЬКА ПОЛІТЕХНІКА»**

**КАФЕДРА «ІНОЗЕМНА ФІЛОЛОГІЯ ТА ПЕРЕКЛАД»**

**МЕТОДИЧНІ ВКАЗІВКИ  
ДЛЯ ПРАКТИЧНИХ ЗАНЯТЬ ТА САМОСТІЙНОЇ РОБОТИ  
З ДИСЦИПЛІНИ «ПРАКТИКА ПЕРЕКЛАДУ З ПЕРШОЇ МОВИ  
НАУКОВО-ТЕХНІЧНОЇ ЛІТЕРАТУРИ»**

для здобувачів першого (бакалаврського) рівня вищої освіти  
всіх форм навчання  
за освітньою програмою «Германські мови та літератури  
(переклад включно)»

Методичні вказівки для практичних занять та самостійної роботи з дисципліни «Практика перекладу з першої мови науково-технічної літератури» для здобувачів першого (бакалаврського) рівня вищої освіти всіх форм навчання за освітньою програмою «Германські мови та літератури (переклад включно)» Запоріжжя: НУ «ЗП», 2024. 40 с.

Укладач: Куц Е.О., доц., к. філол. н.

Рецензент: Лут К. А., філол. н., доц.

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## I. MACHINE BUILDING

### **1. Read and translate the text into Ukrainian analyzing lexical and grammatical transformations**

Machine device, having a unique purpose that augments or replaces human or animal effort for the accomplishment of physical tasks. This road category encompasses such simple devices as the inclined plane, lever, wedge, wheel and axle, pulley, and screw (the so-called simple machines) as well as such complex mechanical systems as the modern automobile.

The operation of a machine may involve the transformation of chemical, thermal, electrical, or nuclear energy into mechanical energy, or vice versa, or its function may simply be to modify and transmit forces and motions. All machines have an input, an output, and a transforming or modifying and transmitting device.

Machines that receive their input energy from a natural source, such as air currents, moving water, coal, petroleum, or uranium, and transform it into mechanical energy are known as prime movers. Windmills, waterwheels, turbines, steam engines, and internal-combustion engines are prime movers. In these machines the inputs vary; the outputs are usually rotating shafts capable of being used as inputs to other machines, such as electric generators, hydraulic pumps, or air compressors. All three of the latter devices may be classified as generators; their outputs of electrical, hydraulic, and pneumatic energy can be used as inputs to electric, hydraulic, or air motors. These motors can be used to drive machines with a variety of outputs, such as materials processing, packaging, or conveying machinery, or such appliances as sewing machines and washing machines. All machines of the latter type and all others that are neither prime movers, generators, nor motors – may be classified as operators. This category also includes manually operated instruments of all kinds, such as calculating machines and typewriters.

In some cases, machines in all categories are combined in one unit. In a diesel-electric locomotive, for example, the diesel engine is the prime mover, which drives the electric generator, which, in turn, supplies electric current to the motors that drive the wheels.

As part of an introduction to machine components, some examples supplied by an automobile are of value. In an automobile, the basic problem is harnessing the explosive effect of gasoline to provide power to rotate the rear wheels. The explosion of the gasoline in the cylinders pushes the pistons down, and the transmission and modification of this linear motion to rotary motion of the crankshaft is effected by the connecting rods that join each piston to the cranks that are part of the crankshaft. The piston, cylinder, crank, and connecting rod combination is known as a slider-crank mechanism; it is a commonly used method of converting translation to rotation (as in an engine) or rotation to translation (as in a pump).

To admit the gasoline-air mixture to the cylinders and exhaust the burned gases, valves are used; these are opened and closed by the wedging action of cams (projections) on a rotating camshaft that is driven from the crankshaft by gears or a chain.

In a four-stroke-cycle engine with eight cylinders, the crankshaft receives an impulse at some point along its length every quarter revolution. To smooth out the effect of these intermittent impulses on the speed of the crankshaft, a flywheel is used. This is a heavy wheel, attached to the crankshaft, which by its inertia opposes and moderates any speed fluctuations.

Since the torque (turning force) that it delivers depends on its speed, an internal-combustion engine cannot be started under load. To enable an automobile engine to be started in an unloaded state and then connected to the wheels without stalling, a clutch and a transmission are necessary. The former makes and breaks the connection between the crankshaft and the transmission, while the latter changes, in finite steps, the ratio between the input and output speeds and torques of the transmission. In low gear, the output speed is low and the output torque higher than the engine torque, so that the car can be started moving; in high gear, the car is moving at a substantial speed and the torques and speeds are equal.

The axles to which the wheels are attached are contained in the rear axle housing, which is clamped to the rear springs, and are driven from the transmission by the drive shaft. As the car moves and the springs flex in response to bumps in the road, the housing moves relative to the transmission; to permit this movement without interfering with the transmission of torque, a universal joint is attached to each end of the drive shaft.

The drive shaft is perpendicular to the rear axles. The right-angled connection is usually made with bevel gears having a ratio such that the axles rotate at one-third to one-fourth the speed of the drive shaft. The rear axle housing also holds the differential gears that permit both rear wheels to be driven from the same source and to rotate at different speeds when turning a corner.

Like all moving mechanical devices, automobiles cannot escape from the effects of friction. In the engine, transmission, rear axle housing, and all bearings, friction is undesirable, since it increases the power required from the engine; lubrication reduces but does not eliminate this friction. On the other hand, friction between the tires and the road and in the brake shoes makes traction and braking possible. The belts that drive the fan, generator, and other accessories are friction-dependent devices. Friction is also useful in the operation of the clutch.

Some of the devices cited above are found in machines of all categories, assembled in a multitude of ways to perform all kinds of physical tasks. The function of most of these basic mechanical devices is to transmit and modify force and motion. Other devices, such as springs, flywheels, shafts, and fasteners, perform supplementary functions.

A machine may be further defined as a device consisting of two or more resistant, relatively constrained parts that may serve to transmit and modify force and motion in order to do work. The requirement that the parts of a machine be resistant implies that they be capable of carrying imposed loads without failure or loss of function. Although most machine parts are solid metallic bodies of suitable proportions, nonmetallic materials, springs, fluid pressure organs, and tension organs such as belts are also employed.

## 2. Match terms with their definitions

1. Machine	a. a mechanism that converts reciprocating motion into rotary motion or vice versa
2. Lever	b. a device that is used to connect or disconnect two rotating shafts
3. Shaft	c. a rotating rod that transmits power from one part of a machine to another
4. Electrical	d. a wheel with teeth that meshes with the teeth of

energy	another wheel to transmit power
5. Power	e. the rate at which work is done
6. Transmission	f. the transfer of energy that occurs when a force acts on an object and displaces it in the direction of the force drive spreads
7. Motion	g. the act of applying a lubricant to a machine to reduce friction
8. Slider-crank mechanism	h. a device having a unique purpose, that augments or replaces human or animal effort for the accomplishment of physical tasks
9. Clutch	i. a simple device that consists of a rigid bar resting on a fulcrum and is used to transmit or increase force
10. Force	j. the twisting force that tends to cause an object to rotate
11. Lubrication	k. the act or process of moving
12. Work	l. the system of gears that transmits power from the engine to the wheels of a motor vehicle
13. Gear	m. energy that is associated with the flow of electric charges
14. Motor	n. a mechanism that converts electrical energy into mechanical energy
15. Torque	o. an influence that causes an object to move or change its speed or direction

### **3.Translate into Ukrainian and learn the following terms and terminological combinations**

Lead screw, axle, piston, bearing, clutch, switch, fastner, corrosion resistance, rotary motion, screw water pump, fastening screw, cutting thread, strength, coating, rolling-element bearing, brittleness, chain, rope, automated laboratory equipment, to supply, a milling machine, ballscrew, to produce, to attach, rotating rolling die, chain drive, linkage, to utilize, rotational speed, to refine, cold-rolled thread, turning rotary motion, nut, pulley, belt.

**4. Fill in the gaps with suitable terms and terminological combination and translate the text into Ukrainian**

*Cutting thread, automated laboratory equipment, to supply, to refine, screw, cold-rolled thread(2), screw water pump, lead screw(2), cutting thread, screw fastener, rotating rolling die, machine building, nut, lath, to form, rotary motion, turning rotary motion, milling, to attach.*

**Eichenberger Lead screws - Refined For The Future**

Utilising a simple idea of converting (1)\_\_\_\_\_ to linear motion, lead screws give quick, efficient, accurate and precise linear motion control with small to large lifting capacities. The biggest change in lead screw technology over the years has been in how the thread itself is (2)\_\_\_\_\_ , as Moore International CEO Mark Moore explains.

(3)\_\_\_\_\_ technology can be found throughout history in many forms. Early examples can be seen in the olive oil and wine presses of ancient Greece. Roman history books also show examples of screw technology being used in simple (4)\_\_\_\_\_ and early surgical instruments.

The Greek mathematician Archimedes is usually credited to the invention of the screw around 240BC with the design of the 'Archimedes (5)\_\_\_\_\_ '. It is often disputed that this design seems to have been borrowed from the even earlier times of ancient Egypt. It is safe to say that the knowledge of (6)\_\_\_\_\_ to linear motion with the use of a screw has been known for a very, very long time.

From these early examples millennia ago, there was very little development in screw technology until the Renaissance period of the 15th century. Leonardo da Vinci's works contain descriptions of tools for (7)\_\_\_\_\_ and extensive designs for various moving and fastening screws that are still in existence today.

This was followed by the Industrial revolution in the 16th century, where screws were being manufactured in factories, allowing cheaper faster production and wider use. By the 18th Century in Europe, screws were manufactured and cut on mass using (8)\_\_\_\_\_. The lathes used cutting tools mounted on a nut moving along a threaded shaft. This is an early example of Leadscrews being used in a similar way to how they are used today.

Nowadays, (9)\_\_\_\_\_ can be found everywhere in modern technology, such as printers, scanners, CNC machines, robots, (10)\_\_\_\_\_, lifts and many other applications.

Moore International has been in the linear motion industry for over 30 years and has (11)\_\_\_\_\_ thousands of metres of precision lead screws all around the world. It is the UK distributor and supplier of Swiss manufacturer Eichenberger Gewinde's leadscrews and ballscrews. Eichenberger leadscrews and (12)\_\_\_\_\_ have become an industry standard in quality high-precision, produced using the company's (13)\_\_\_\_\_ forming process.

Typical leadscrew thread manufacturing processes such as (14)\_\_\_\_\_, turning or whirling involve machines cutting the material, with the disadvantage of interrupting the grain of the steel. However Eichenberger's cold-rolling produces very precise thread geometries with high surface quality. Instead of cutting, a radial dynamic force is exerted onto the shaft between two (15)\_\_\_\_\_ to form the thread. Thread-rolling diverts the longitudinal grain of the metal, hardening the surface profile at the same time. This 'smooth rolled surface' offers little opportunity for dirt (16)\_\_\_\_\_ aiding in low friction, low noise, long service life and giving excellent energy efficiency of the (17)\_\_\_\_\_.

Technological progress in (18)\_\_\_\_\_ and automation has resulted in increased complexity for design engineers. Leadscrews are among the most frequently used drive systems in many areas due to their simplicity and reliability. Using Eichenberger's range of leadscrews give a wider choice of possibilities to designers. Eichenberger's (19)\_\_\_\_\_ shafts give them clear performance advantages in any situation. The Eichenberger range includes:

SPEEDY - Eichenberger Speedy high-helix leadscrews give unprecedented high travel speeds from very low rotational speeds

RONDO - Eichenberger Rondo round-thread leadscrews give high levels of efficiency with extremely low noise levels. An ideal alternative to conventional trapezoidal leadscrews.

EASY - Eichenberger Easy, lightweight rolled aluminium leadscrews with a friction-resistant coating (hard anodised). Ideal for increased loads in challenging climatic conditions or difficult environments.

All can be combined with a choice of nut material and optional low friction and protective coatings.

Moore International can supply off-the-shelf or in-house custom CNC machined leadscrews made to your requirements; and by choosing Eichenberger leadscrews you can be sure of precision from start to finish.

Although it's unclear whether it was the Greeks or Egyptians who are responsible for the discovery of screw technology leading to the invention of the leadscrew, we can definitely say it is Eichenberger with its cold-rolled threads that has (20)\_\_\_\_\_ it for the future.

### 5. Translate into English the following terms and terminological combinations

Тертя, машинобудування, обертальний рух, гайка, ходовий гвинт, очищувати; підвищувати якість, поршень, лезо, перемикач, гвинтова нарізка, вісь, поворотно-обертальний рух, гвинт кріплення, фрезерний верстат, корозійна стійкість, покриття, виробляти, автоматизоване лабораторне обладнання, важіль, ланцюг, забезпечити, кріплення, різьблення, зубчасте колесо, кульковий гвинт, канат, важільна передача, повзунково-кривошипний механізм, вал, мастило, двигун, муфта, крутний момент, стрічка (конвеєра), ланцюгова передача.

### 6. Translate sentences into English paying attention to the underlined terms

1. Важливо правильно підібрати муфту для верстата, щоб забезпечити надійне з'єднання та передачу обертального моменту.

2. Точний рух каретки верстата забезпечується за допомогою ходового гвинта.

3. Використання фрезерних верстатів з ЧПУ дозволяє автоматизувати процес обробки деталей, що значно підвищує продуктивність праці та знижує собівартість продукції.

4. Важливо правильно розрахувати навантаження на важіль і ланцюг, щоб уникнути їх пошкодження.

5. Повзунково-кривошипний механізм може використовуватися в різних механізмах для перетворення обертального руху в поступальний або навпаки.

6. В результаті аналізу конструкцій дискових фрез для оброблення пазів та уступів обрана конструкція фрези з механічним кріпленням.

7. Максимальні еквівалентні напруження в елементах гальмової важільної передачі нижчі майже на 35% у порівнянні з типовою схемою.

8. Колінчасті вали виготовляють з вуглецевих, хромомарганцевих, хромо-нікель-молібденових, та інших сталей методом кування.

9. Зубчасте колесо редуктора плавно передавало обертальний момент від валу електродвигуна до привідного механізму верстата.

10. Кульковий гвинт преса забезпечував точне та плавне переміщення штока.

## **7. Translate the following text into Ukrainian paying attention to the terms and terminological combinations**

The challenges of today's machine building industry The ramping up of the low wage economies in the machine building sector means that OEMs often feel they are working under the shadow of the threat of cheap imports. In the first of a series of articles, Robert Brooks looks at the 'must-have' features that will keep UK machine builders ahead of the pack, and the opportunities to add even greater value. In the last 20 years, machine building in the UK has changed beyond recognition. Of course some of this is driven by new technology, but much more is about meeting today's vastly different user requirements whilst also fending off competition from low cost entrants to the market.

Naturally price is a pressure, but end users tend to be more focused on speed, reliability, flexibility and lifetime costs. At the same time, the requirement to differentiate them from the competition means that machine builders are building a lot more one-off machines and special purpose machines, ideally without impacting on either development time or cost. These two sets of criteria would appear to be in contradiction but it doesn't have to be so, as the latest automation technologies give machine builders all the tools they need to develop vastly superior machine designs, more quickly and more cost-effectively.

The issue of speed is interesting because it means different things to different industries, and certainly overall speed is less of an issue in

particular sectors. But no machine builder is ever asked to develop a machine that is slower than the previous generation. And of course machine builders themselves all have a determination to constantly improve machine performance. Speed goes hand in hand with productivity – absolute cycle time means nothing if half the products coming off the end of the line are scrap, or if it impacts negatively on availability. So speed is also tied to reliability, and end users have become adept at monitoring uptime, availability and productivity to produce overall equipment effectiveness (OEE) scores that benchmark the performance of different product lines, in different plants, in different regions of the world. Flexibility, too, is a key issue.

Much has been written over the years of the need for pushbutton changeover between product variants coming onto the production line, but today flexibility goes far beyond that. End users are looking for machines that can enable production line capability to be modified quickly and easily, perhaps by adding a robot based pick and place station when required or adding a specific machine module. Just as OEMs talk about ‘plug and play’ with regard to integrating automation technologies, so end users are developing a plug and play mindset with regard to adding functionality to production lines.

Finally there is the issue of the lifetime cost of the machine. Yes the purchase price is important, but end users also want easy upgrade paths to extend the working life the machine, will tie in lifetime cost with reliability, will factor in the cost of support, and will also monitor cost per product as part of benchmarking the effectiveness of the machine. The question arises, then, of how machine builders can offer all of this – developing advanced machines cost-effectively that tick all the boxes for performance and flexibility whilst being easy to support. And what are the opportunities to build in even greater differentiation to develop a real competitive advantage Control and automation technologies

The key lies in today’s automation technologies and control solutions, with machine controllers at the heart but embracing open communications and technologies such as servos, vision, robotics and safety, and exploiting the ever growing capability and diagnostics functionality of drives, sensors and HMIs, and tying this all together through open standard programming and development software. Some machine builders will have the luxury of being able to impose their own automation platform standards, or to select best of breed components.

Others will have a control platform requirement imposed on the specification. Happily, with open communications industrial.omron.co.uk Machine building & Automation | 2 standards and open standard programming structures such as IEC 61131-3, no design effort is ever wasted. Function blocks developed in software for one job can be easily ported to another.

Hardware systems implemented on one machine on a given platform can be readily scaled up or even changed to an entirely different platform on another. There is no ‘one size fits all’ solution for machine control, but open standards mean that this represents an opportunity rather than a limitation. At the same time, open communications standards based on industrial Ethernet structures not only simplify machine component integration at the local level, but also the integration of the machine within the production line and the higher level enterprise.

And industrial Ethernet also opens up the possibility of remote access into the machine, bringing advantages to end users as they look to monitor and control different plants in different areas of the world, but also to machine builders as they look to add value by offering ever better support, whilst reducing the cost implications of that support.

There can be very few machine builders who can afford to be sending out members of the development team on service and support operations. But remote access and advanced diagnostics capability mean that many seemingly complex machine problems can be potentially fixed in minutes remotely. There are many opportunities to add value in terms of machine performance, too.

A recent report from PLCopen looked at the benefits of servo technology. The report highlighted how servos not only significantly boost machine performance, but importantly – and perhaps unexpectedly – also reduce machine cost and complexity. It examined the case of a specific food packaging machine, with the traditional mechanical design elements replaced by multi axis servos.

In the new design, the number of pulleys was reduced from 45 to 0, the number of belts from 15 to 0, drive sprockets from 15 to 0, spline shafts from 2 to 0, bearings from 18 to 3 and line shafts from 6 to 0, while the motor count increased from 1 to 10. The result was an 81% overall reduction in parts from 118 down to 23. The end result was a faster, better, lower cost and significantly more compact machine.

Servo technology can today be regarded as plug and play – simple to integrate and program. The same can be said of vision technology, too, which can play a huge role on production lines in quality assurance, minimising rejects, traceability and more. In subsequent articles in this series we'll look at specific automation technologies in detail, and how machine builders can best exploit them to develop machines that offer greater performance without impacting on cost or development time.

## **8. Translate the following texts into English paying attention to the terms and terminological combinations**

Токарна група верстатів має домінуючу позицію в парку обладнання будь якого підприємства. До цього парку належить велика кількість найрізноманітніших типів верстатів. Найбільш поширеним на підприємстві «Зоря»-«Машпроект», м. Миколаїв, Україна є токарно-гвинторізний верстат моделі 1М63, що є швидкісним універсальним станком і призначений для виконання різноманітних токарських і гвинторізних робіт з чорними та кольоровими металами, а саме точіння конусів, нарізування метричних, дюймових, модульних та піччевих різьб. Жорстка конструкція верстату, високий ліміт чисел обертів шпинделю (1250 об/хв) та відносно велика потужність приводу (13 кВт) надають можливість використовувати його як швидкісний з використанням різців з швидкоріжучої сталі та твердих сплавів.

Верстат токарно-гвинторізний 1М63. Вдосконалення верстата відбувається шляхом додавання до конструкції двох необхідних для цього складових: числового програмного керування та комплектного електропривода. Як результат верстат перетворюється на складну автоматичну систему з точного серійного виробництва, що вимагає від оператора верстату лише іноді підналагодження системи, вибіркового контролю якості деталей та переналагодження програми верстату, коли необхідно перейти до виготовлення інших деталей.

Електропривод головного руху має електродвигун і коробку швидкостей або редуктор в якості пристрою, що передає рух виконавчому органу верстата. Можлива відсутність передаючого пристрою, коли двигун з'єднується безпосередньо з виконавчим

органом. Розповсюдженими приводами головного руху верстатів є приводи від одно- та багатошвидкісних асинхронних двигунів з короткозамкненим ротором зі ступінчастим регулюванням швидкості шляхом перемикання шестерень коробки швидкостей. Перемикання виконується дистанційно різноманітними пристроями, серед яких найбільш розповсюджені пристрої з фрикційними електромагнітними муфтами, що вбудовуються в коробку швидкостей, а також з електричними виконавчими двигунами і гідравлічними механізмами.

Використання електроприводу змінного струму зі ступінчастим регулюванням швидкості різання не спроможне забезпечити повну продуктивність. Використання коробки швидкостей зі складною кінематикою зменшує точність роботи верстату і підвищує його вартість. Тому привод головного руху виконується у вигляді регульованого електропривода з простим редуктором чи двоступінчастою коробкою швидкостей та дистанційним перемиканням. Для приводів головного руху найбільш раціональним є спосіб регулювання швидкості з постійною потужністю, так як більшим швидкостям різання відповідає менше зусилля різання, а меншим швидкостям – більші зусилля.

Діапазон регулювання частоти обертання визначається межами швидкостей різання та діаметрів оброблюваних виробів. Це зумовлено тим, що на універсальних верстатах можуть оброблюватися деталі з різноманітних матеріалів і різних розмірів, у тому числі різних діаметрів. Для обробки виробів однакового діаметра з різноманітних матеріалів на обхідно забезпечити певний діапазон регулювання швидкості різання. З іншого боку, раціональна обробка виробів з одного й того самого матеріалу, але різних діаметрів, потребує постійної швидкості різання.

Виконання умови  $v = \text{const}$  досягається регулюванням швидкості привода з діапазоном регулювання, що визначається діапазоном діаметрів. Так, для токарних верстатів з діаметром встановлюваних виробів 320...1000 мм потрібний діапазон регулювання частот обертання приблизно 50:1, а для токарнокарусельних верстатів з діаметром оброблюваного виробу від 1250 до 4000 мм він доходить до 80:1.

Числове програмне керування (ЧПК) – комп'ютеризована система керування, яка зчитує командні інструкції спеціалізованої мови програмування і керує приводами верстатів та верстатним

оснащенням. Верстати, обладнані числовим програмним керуванням, називаються верстатами з ЧПК. Інтерпретатор системи ЧПК проводить переведення програм з вхідної мови в команди керування головним приводом, приводами подач, контролерами керування вузлами верстата. Для визначення необхідної траєкторії руху робочого органу в цілому відповідно до керуючої програми, використовується інтерполятор, що розраховує положення проміжних точок траєкторії відповідно до заданих у програмі кінцевих точках. У верстатах з числовим програмним керуванням (ЧПК) функції, що виконуються електроприводом головного руху, значно ускладнені. На швидкостях нижче номінальних регулювання виконується з постійним моментом. Таким чином отримується двохзонне регулювання швидкості.

При невеликій потужності головного приводу застосовують однозонне регулювання швидкості з постійним моментом. У електроприводах подач найбільше застосування отримали передачі «гвинт – гайка» або «шестірня – рейка». Застосовуються високомоментні двигуни зі збудженням від постійних магнітів, що розраховані на встановлення безпосередньо на ходовий гвинт, що суттєво скорочує механічну частину привода, знижує його момент інерції і підвищує ККД.

Для підвищення продуктивності верстатів переміщення виконавчих органів до зони обробки виконується на швидких ходах тими самими електроприводами подачі. Через незадовільні динамічні властивості регульованого електропривода, особливо при збурюванні за навантаженням, з'являється шорсткість поверхні, тому важливо забезпечити високу швидкодію привода при підключенні та відключенні навантаження, а також при реверсі двигуна під навантаженням на найменших частотах обертання.

## II. AUTOMOTIVE ENGINEERING

### **1. Read and translate the text into Ukrainian analyzing lexical and grammatical transformations**

An automobile is a self-propelled motor vehicle intended for passenger transportation on land. It usually has four wheels and an internal combustion engine fueled most often by gasoline, a liquid petroleum product. Known more commonly as a car, formerly as a motorcar, it is one of the most universal of modern technologies, manufactured by one of the world's largest industries. More than 73 million new automobiles were produced worldwide in the year 2017.

The scientific and technical building blocks of the automobile go back several hundred years. For example, in the late 1600s, Dutch scientist Christiaan Huygens invented a type of internal combustion engine sparked by gunpowder. The «horseless carriage» in its modern form had been developed by the end of the 19th century. At that time, it was not clear which of three fuel sources would become most commercially successful: steam, electric power, or gasoline. Cars run by steam engines could go at high speeds but had a short range and were inconvenient to start. Battery-powered electric cars had a 38 percent share of the United States automobile market in 1900, but they also had a limited range and recharging stations were hard to find.

The gasoline-powered automobile won the competition. By 1920, it had overtaken the streets and byways of Europe and the United States. The manufacturing methods introduced by U.S. carmaker Henry Ford revolutionized industrial manufacturing. Ford was the first to install assembly lines in his factory to speed up production. Such techniques reduced the price of Ford's Model T until it became affordable for most middle-class families. As the 20th century progressed, modern life came to seem increasingly inconceivable, or at least highly inconvenient, without access to a car. Nowadays, the U.S. population drives more than 4.8 trillion

kilometers (three trillion miles) every year on average. But this fundamental component of industrial and consumer society has played a major role in destabilizing Earth's atmosphere, on which all living things depend. The average automobile emits between four and nine tons (3,629 to 8,165 kilograms; 8,000 to 18,000 pounds) of carbon dioxide and other greenhouse gases per year. Every gallon of gasoline burned to operate a car emits just under 9.1 kilograms (20 pounds) of carbon dioxide. The transportation sector as a whole, including cars, trucks, trains, and aircraft, became the largest source of U.S. greenhouse gas emissions in 2017. Air pollution from automobile exhaust is also a major problem, as are car accidents, which killed more than 100 people per day in the United States in 2016, according to the National Highway Traffic Safety Administration.

## 2. Match terms with their definitions

1. <b>anti-lock braking system (ABS)</b>	a. a device in the exhaust system that reduces harmful emissions by converting toxic gases into less harmful substances
2. <b>differential</b>	b. a mechanical system that prevents the wheels from locking during braking to maintain steering control
3. <b>catalytic converter</b>	c. the system of gears that transfers power from the engine to the wheels, allowing for different speeds and torque
4. <b>torque converter</b>	d. a unit in an automatic transmission that transmits and multiplies torque from the engine to the transmission

<b>5. fuel injection system</b>	e. a system that delivers a precise amount of fuel into the combustion chamber of an engine
<b>6. turbocharger</b>	f. a device that uses exhaust gases to spin a turbine, forcing more air into the engine for increased power
<b>7. transmission</b>	g. a gearbox and its components that allow the driver to control the vehicle's speed and power delivery
<b>8. chassis</b>	h. the frame of a motor vehicle, excluding the body and engine
<b>9. suspension system</b>	i. a system that supports the vehicle, absorbs shocks, and maintains tire contact with the road surface
<b>10. oversteer</b>	j. a tendency of a vehicle to turn more sharply than intended, often causing the rear wheels to lose grip
<b>11. wheel alignment</b>	k. the process of adjusting the angles of wheels so that they are set to the car manufacturer's specifications
<b>12. hybrid powertrain</b>	l. a combination of an internal combustion engine and an electric motor to power a vehicle
<b>13. ignition coil</b>	m. a component that transforms the battery's low voltage to a high voltage needed to create an electric spark in spark plugs
<b>14. telematics system</b>	n. an integrated system combining telecommunications and informatics to monitor vehicle performance, provide navigation, and enable remote diagnostics or tracking
<b>15. lane departure warning system (LDWS)</b>	o. a driver-assistance feature that alerts the driver when the vehicle unintentionally drifts out of its lane without using a turn signal

### **3. Translate into Ukrainian and learn the following terms and terminological combinations**

anti-lock braking system (ABS), electronic stability control (ESC), regenerative braking system, adaptive cruise control (ACC), lane keeping assist system (LKAS), blind spot monitoring system, variable valve timing (VVT), dual-clutch transmission (DCT), continuously variable transmission (CVT), limited-slip differential (LSD), traction control system (TCS), aerodynamic drag coefficient, active suspension system, hydraulic power steering, electric power-assisted steering (EPAS), turbocharged direct injection (TDI), exhaust gas recirculation (EGR), on-board diagnostics (OBD-II), vehicle-to-infrastructure communication (V2I), plug-in hybrid electric vehicle (PHEV), battery management system (BMS), thermal management system, collision avoidance system, crumple zone engineering, aerodynamic downforce, torque vectoring control, automated emergency braking (AEB), predictive maintenance algorithms, four-wheel drive (4WD) system, hydrogen fuel cell powertrain.

### **4. Fill in the gaps with suitable terms and terminological combination and translate the text into Ukrainian**

*adaptive, computer-aided engineering (CAE), occupant, regenerative, emission, powertrain, infotainment, hybrid-material, ladder, parasitic, continuously variable (CVT), lithium-ion battery, autonomous, anti-corrosion, start-stop, fuel, sustainable, internal combustion engine, driver-assistance, drive-by-wire*

The modern automobile is the result of over a century of technological progress, integrating advanced (1) \_\_\_\_\_ **systems** with refined engineering design. One of the most notable developments in recent decades has been the transition from purely mechanical control mechanisms to (2) \_\_\_\_\_ **systems**, in which essential driving functions are monitored and adjusted by onboard microprocessors.

The (3) \_\_\_\_\_ remains the dominant propulsion unit in most vehicles, though alternative power units are gaining popularity. In the case

of electric cars, the (4) \_\_\_\_\_ **pack** replaces the conventional fuel tank, supplying electrical energy to the traction motor through high-voltage inverters. Hybrid vehicles combine both propulsion types, optimising efficiency through (5) \_\_\_\_\_ **braking**, which recovers kinetic energy during deceleration.

Safety is another major priority in modern automotive design. Passenger protection relies on (6) \_\_\_\_\_ **restraint systems**, crumple zones, and side-impact beams that absorb and dissipate collision forces. Moreover, (7) \_\_\_\_\_ **assistance systems** such as lane departure warning, adaptive cruise control, and forward collision alerts are now common, utilising radar, lidar, and camera-based sensors.

From a structural point of view, the body of a car can be mounted on a (8) \_\_\_\_\_ **frame** or built as a unibody construction. The choice of materials—ranging from ultra-high-strength steel to aluminium alloys and carbon-fibre composites—affects both (9) \_\_\_\_\_ **efficiency** and crash resistance. Weight reduction strategies include the use of (10) \_\_\_\_\_ **components**, which combine metal and polymer elements to balance strength and weight.

In the drivetrain, (11) \_\_\_\_\_ **transmissions** have become increasingly popular, offering smooth gear shifts and adaptive performance. Electric power steering has replaced traditional hydraulic systems in many models, reducing (12) \_\_\_\_\_ **losses** and improving steering response. Suspension systems now incorporate (13) \_\_\_\_\_ **damping**, which adjusts shock absorber settings in real time to road conditions.

The production process is highly automated: robotic arms perform welding, (14) \_\_\_\_\_ **coating**, and precise assembly of engine and body components. However, quality control still requires human expertise to identify defects that automated systems may overlook. Increasingly, manufacturers use (15) \_\_\_\_\_ **simulation** to test vehicle aerodynamics, crash performance, and component durability before physical prototypes are built.

Environmental regulations have pushed automakers to invest heavily in (16) \_\_\_\_\_ **control technologies**. Exhaust after-treatment systems—such as catalytic converters, selective catalytic reduction (SCR), and particulate filters—have significantly lowered harmful emissions. The adoption of (17) \_\_\_\_\_ **cycles** in engine calibration helps optimise fuel consumption and meet stringent emission targets.

The future points toward (18) \_\_\_\_\_ **mobility**, characterised by autonomous driving, shared fleets, and renewable energy integration. The implementation of (19) \_\_\_\_\_ **driving features** allows cars to navigate, accelerate, and brake without constant driver input, relying on advanced artificial intelligence algorithms. At the same time, (20) \_\_\_\_\_ **systems** enhance the in-car experience, offering seamless connectivity, navigation, entertainment, and real-time traffic updates.

### 5. Translate into English the following terms and terminological combinations

двигун внутрішнього згоряння, система рециркуляції вихлопних газів, крутний момент, гальмівний шлях, система запалювання, підвіска з незалежними важелями, система контролю тиску в шинах, витрата пального, система пасивної безпеки, варіаторна коробка передач, рекуперативне гальмування, акумуляторна батарея високої напруги, датчик положення колінчастого вала, система допомоги під час паркування, деформівна зона кузова, бортова діагностика, гідропідсилювач керма, система попередження про вихід зі смуги, аеродинамічний опір, каталітичний нейтралізатор.

### 6. Translate sentences into English paying attention to the underlined terms

1. Сучасний автомобіль оснащений **системою адаптивного круїз-контролю**, яка підтримує безпечну дистанцію між транспортними засобами.

2. Ефективність роботи **двигуна внутрішнього згоряння** залежить від якості палива і технічного стану.

3. **Рекуперативне гальмування** допомагає знизити втрати енергії під час руху в міському циклі.

4. Для безпеки пасажирів встановлена **система пасивної безпеки** з подушками безпеки і ременями.

5. **Варіаторна коробка передач** забезпечує плавне переключення передач без втрати потужності.

6. Автомобіль оснащений **датчиком тиску в шинах**, що сигналізує про зниження тиску.
7. Завдяки **системі старт-стоп** значно зменшується споживання пального в пробках.
8. Використання **легких композитних матеріалів** в конструкції кузова покращує паливну ефективність.
9. **Система допомоги при паркуванні** дозволяє водієві уникнути зіткнень із перешкодами.
10. Автомобіль проходить тестування на **аеродинамічний опір** для підвищення ефективності використання пального.

### 7. Translate the following text into Ukrainian paying attention to the terms and terminological combinations

The global automotive industry is entering a new era marked by rapid technological change, stricter environmental standards, and shifting patterns of consumer behaviour. Whereas for over a century the defining feature of the automobile was its **internal combustion engine**, today the industry is diversifying towards **electric drivetrains**, **hybrid propulsion systems**, and alternative fuels such as hydrogen. These new power sources are supported by **lithium-ion battery packs**, high-voltage **inverter systems**, and **regenerative braking technologies** designed to capture and reuse kinetic energy that would otherwise be lost during deceleration.

A key driver of innovation has been the pursuit of greater safety and automation. Modern vehicles are equipped with advanced **driver-assistance systems** (ADAS) that include adaptive cruise control, lane departure warning, traffic sign recognition, and automated emergency braking. The development of **autonomous driving capabilities** is progressing rapidly, with several manufacturers already testing vehicles capable of operating without human intervention under certain conditions. These systems rely on an intricate combination of **lidar sensors**, high-resolution cameras, radar units, and **artificial intelligence algorithms** capable of processing vast amounts of data in real time.

Design and engineering priorities have also shifted towards efficiency and sustainability. The use of **lightweight composite materials**, **high-strength aluminium alloys**, and even **carbon fibre-reinforced plastics** has become common practice to reduce overall vehicle mass. This weight

reduction improves fuel efficiency and performance, particularly when combined with **aerodynamically optimised body shapes** that minimise **drag coefficients**. Many manufacturers have transitioned from traditional **ladder frame constructions** to **unibody chassis designs**, which enhance rigidity while allowing for more efficient crash energy absorption.

Drivetrain technologies are evolving as well. Traditional manual and automatic gearboxes are being complemented – or replaced – by **continuously variable transmissions (CVTs)**, dual-clutch transmissions, and even **direct-drive electric systems** that eliminate the need for multiple gears altogether. Steering systems have shifted towards **electric power-assisted steering (EPAS)**, reducing **parasitic losses** compared to hydraulic systems and offering improved precision. Suspension systems now incorporate **adaptive damping control**, which can adjust shock absorber settings within milliseconds to suit changing road conditions and driving styles.

On the manufacturing side, the adoption of **Industry 4.0 principles** has revolutionised production lines. Fully automated **robotic assembly systems** handle tasks such as precision welding, laser cutting, **anti-corrosion coating**, and the installation of intricate electronic modules. Quality control is enhanced through **computer-aided engineering (CAE) simulations** and **digital twin models**, allowing engineers to test vehicle performance under virtual conditions before building physical prototypes. This not only reduces development costs but also shortens time-to-market for new models.

Environmental regulations are reshaping the way vehicles are designed and built. In response to strict emissions targets, carmakers have invested heavily in **exhaust after-treatment systems** such as catalytic converters, diesel particulate filters (DPFs), and **selective catalytic reduction (SCR)** units. Engine optimisation now includes **start-stop systems**, variable valve timing, and **turbocharging** to achieve higher efficiency without sacrificing performance. In parallel, charging infrastructure for electric vehicles is expanding, with fast-charging networks and **wireless charging pads** becoming increasingly common in urban areas.

The concept of **sustainable mobility** extends beyond the vehicle itself to the broader transportation ecosystem. Shared mobility platforms, subscription-based car ownership, and **mobility-as-a-service (MaaS)** solutions are gaining traction, particularly in densely populated cities. Vehicles are also becoming more digitally integrated: modern

**infotainment systems** offer cloud connectivity, real-time traffic updates, over-the-air software upgrades, and integration with smart home devices. In many cases, the car is evolving into a **mobile digital hub**, blurring the line between transportation and communication technologies.

Looking ahead, the future of the automobile is likely to be defined by the convergence of electrification, automation, and connectivity. **Solid-state batteries** promise higher energy density and faster charging, while **vehicle-to-everything (V2X) communication** will allow cars to interact with infrastructure, other vehicles, and even pedestrians for enhanced safety. As materials science, artificial intelligence, and manufacturing technology continue to advance, the cars of tomorrow will be cleaner, smarter, and more efficient – reshaping not only the automotive industry but the way people move around the world.

## 8. Translate the following texts into English paying attention to the terms and terminological combinations

Автомобільна промисловість перебуває на етапі глибокої трансформації, зумовленої розвитком новітніх технологій, посиленням екологічних вимог і зміною уподобань споживачів. Якщо раніше домінували транспортні засоби з **двигунами внутрішнього згоряння**, то сьогодні дедалі більшої популярності набувають **електромобілі, гібридні силові установки** та транспорт на основі **водневих паливних елементів**. У таких автомобілях традиційний **паливний бак** замінюють **літій-іонні акумуляторні батареї**, що живлять **тягові електродвигуни** через **високовольтні інвертори**.

Важливою складовою електротранспорту є **система рекуперативного гальмування**, яка дає змогу перетворювати кінетичну енергію під час уповільнення на електричну та зберігати її в батареї. Це не лише підвищує енергоефективність, але й зменшує зношування **гальмівних колодок**.

Сучасні автомобілі також оснащуються широким спектром **систем допомоги водієві (ADAS)**, до яких належать **адаптивний круїз-контроль, система утримання смуги руху, система автоматичного екстреного гальмування та моніторинг сліпих зон**. Розвиток технологій **автономного водіння** дозволяє автомобілям рухатися без

постійного втручання водія, використовуючи **лідар**, камери високої роздільної здатності, радари та **алгоритми штучного інтелекту** для обробки даних у режимі реального часу.

Інженерні рішення у сфері автомобілебудування значно змінилися за останні десятиліття. Використання **легких композитних матеріалів, високоміцних алюмінієвих сплавів і вуглепластиків** дає змогу зменшити масу автомобіля, поліпшити **паливну ефективність** і підвищити динамічні характеристики. Особлива увага приділяється **аеродинамічній оптимізації кузова**, що дозволяє знизити **коефіцієнт опору повітря** та покращити стабільність на високих швидкостях.

Конструкція кузова може базуватися на **рамній основі** або на **несучому кузові (унібоді)**. Останній варіант забезпечує більшу жорсткість і кращий розподіл енергії удару при зіткненнях. Водночас сучасні **зони деформації й системи пасивної безпеки** істотно зменшують ризики для пасажирів у разі аварії.

Трансмісійні технології також розвиваються. Окрім традиційних механічних і автоматичних коробок передач, зростає популярність **варіаторів (CVT), двозчепленсєвих трансмісій** і навіть **прямих електричних приводів**, які взагалі не потребують зміни передач. **Електропідсилювач керма (EPAS)** замінює гідравлічні системи, зменшуючи **паразитні втрати енергії** та забезпечуючи точніше керування. Сучасні підвіски часто оснащуються **системами адаптивного демпфування**, здатними змінювати жорсткість амортизаторів залежно від стану дороги.

У виробництві автомобілів дедалі ширше впроваджуються принципи **Індустрії 4.0**. **Роботизовані маніпулятори** виконують високоточне зварювання, лазерне різання, нанесення **антикорозійних покриттів** і встановлення складних електронних модулів. Перед початком серійного виробництва нові моделі проходять **комп'ютерне моделювання (CAE)** та створення **цифрових двійників** для перевірки **аеродинаміки, ударостійкості та довговічності компонентів**. Це дозволяє знизити витрати на розробку та скоротити час виходу моделі на ринок.

Екологічні вимоги стимулюють розвиток **систем очищення вихлопних газів**, до яких належать **каталітичні нейтралізатори, сажові фільтри (DPF)** та **системи селективного каталітичного відновлення (SCR)**. Для зниження витрат пального використовують

**системи «старт-стоп», змінні фази газорозподілу та турбонаддув.** Паралельно розвивається інфраструктура заряджання електромобілів – від **швидкісних зарядних станцій** до **бездротових зарядних платформ** у міських умовах.

Поняття **сталого транспорту** виходить за межі лише автомобіля та охоплює всю систему мобільності. Набувають популярності **платформи спільного користування автомобілями, транспорт як послуга (MaaS)** та підпискові моделі володіння. **Мультимедійно-інформаційні системи** сучасних автомобілів пропонують **хмарну інтеграцію**, оновлення програмного забезпечення «по повітрю» та синхронізацію з **розумними будинками**. Автомобіль поступово перетворюється на **мобільний цифровий хаб**, який поєднує транспортні та комунікаційні функції.

Майбутнє автомобілебудування, ймовірно, визначатиметься поєднанням електрифікації, автоматизації та повної цифрової інтеграції. **Тверdotільні акумулятори** обіцяють вищу енергомісткість і швидше заряджання, а технології **V2X-комунікацій** забезпечуватимуть взаємодію автомобіля з інфраструктурою, іншими транспортними засобами та навіть пішоходами. Прогрес у сфері матеріалознавства, штучного інтелекту та виробничих технологій зробить автомобілі майбутнього чистішими, розумнішими й ефективнішими, докорінно змінюючи підхід до особистої та громадської мобільності.

### III. AIRCRAFT ENGINEERING

#### 1. Read and translate the text into Ukrainian paying attention to terms

The aviation industry has always been at the forefront of technological innovation, constantly pushing the limits of engineering, safety, and operational efficiency. From the introduction of **jet propulsion systems** in the mid-20th century to the development of **fly-by-wire control technology**, the sector has undergone continuous transformation. Today, the focus is shifting towards sustainability, automation, and digital integration, reshaping how aircraft are designed, manufactured, and operated.

One of the most significant advancements in recent years has been the growing adoption of **composite airframe structures**. Modern airliners increasingly incorporate **carbon fibre-reinforced polymers** and **advanced aluminium-lithium alloys** to reduce weight without compromising structural integrity. Weight reduction is crucial in aviation as it directly impacts **fuel burn, payload capacity, and operational range**. In addition, **laminar flow wing designs** and **aerodynamic optimisation techniques** have been introduced to reduce drag and improve fuel efficiency.

Engine technology has also evolved dramatically. Next-generation **turbofan engines** with **geared fan architectures** offer improved **thrust-to-weight ratios** and significantly lower noise levels. **High-bypass ratio engines** and **open rotor concepts** are being researched to further enhance efficiency and reduce greenhouse gas emissions. Moreover, developments in **sustainable aviation fuel (SAF)** and **hydrogen-powered propulsion systems** are promising solutions to meet ambitious carbon reduction targets set by the International Civil Aviation Organization (ICAO).

Flight control and cockpit technology have seen major advancements as well. Modern commercial aircraft now feature **glass cockpit displays, integrated avionics suites, and head-up displays (HUDs)**, providing pilots with real-time flight data, navigation, and performance monitoring. **Fly-by-wire systems** replace traditional mechanical linkages with electronic signal transmissions, allowing for more precise control and reduced pilot workload. Enhanced **flight management systems (FMS)**

automatically optimise flight paths for fuel savings and minimal environmental impact.

Safety remains the top priority in aviation, and technology plays a central role in improving it. **Traffic collision avoidance systems (TCAS)**, **enhanced ground proximity warning systems (EGPWS)**, and **automatic dependent surveillance–broadcast (ADS-B)** have become standard in modern fleets. These systems enhance situational awareness and reduce the risk of mid-air and ground collisions. Advanced **weather radar systems** with predictive wind shear and turbulence detection capabilities further improve operational safety.

From a manufacturing perspective, aircraft production has embraced **Industry 4.0 principles**. **Robotic drilling and riveting systems**, **automated fibre placement (AFP) machines**, and **additive manufacturing (3D printing)** are now standard in many production facilities. **Digital twin technology** allows engineers to create precise virtual models of aircraft and simulate structural performance under various conditions before physical assembly begins. This approach reduces production time, costs, and the need for costly redesigns.

Airport operations are also evolving. Modern airports are increasingly integrating **biometric passenger identification systems**, **automated baggage handling**, and **remote air traffic control towers**. The implementation of **performance-based navigation (PBN)** procedures and **next-generation air traffic management systems** is enabling more efficient flight routing, reducing delays, and cutting fuel consumption.

The concept of **urban air mobility (UAM)** is emerging as one of the most exciting developments in aviation. Electric vertical take-off and landing (eVTOL) aircraft are being developed for short-range urban transport, promising to alleviate traffic congestion and reduce environmental impact. These aircraft rely on **distributed electric propulsion systems**, **advanced battery technology**, and **autonomous flight control software**. Regulatory frameworks and airspace integration strategies are currently being developed to safely introduce such vehicles into urban environments.

Looking ahead, the future of aviation will be shaped by the convergence of electrification, automation, and connectivity. **Hybrid-electric propulsion systems** are expected to bridge the gap between traditional jet engines and fully electric aircraft, offering reduced fuel consumption for regional and short-haul flights. **Artificial intelligence (AI)** will play a

critical role in predictive maintenance, optimised flight scheduling, and autonomous operations. Furthermore, **satellite-based communication systems** will provide global, high-speed data connectivity for both cockpit operations and passenger services.

While the road ahead is challenging, the aviation industry's commitment to safety, innovation, and environmental stewardship ensures that it will continue to evolve. Whether through the introduction of **net-zero-emission aircraft**, advanced **air traffic management concepts**, or the seamless integration of **unmanned aerial systems (UAS)** into commercial airspace, the skies of tomorrow will be more efficient, sustainable, and connected than ever before.

## 2. Match terms with their definitions

1. jet propulsion system	a. a flight deck equipped with large electronic displays that replace traditional mechanical gauges and instruments
2. fly-by-wire system	b. an aircraft without a human pilot onboard, often remotely controlled or autonomous, used for surveillance, mapping, or delivery
3. composite airframe structure	c. a propulsion method in which a jet engine produces thrust by expelling a high-speed stream of gases to move an aircraft forward
4. carbon fibre-reinforced polymer	d. an electrically powered aircraft capable of taking off and landing vertically, designed for short-range urban or regional travel
5. laminar flow wing design	e. an electronic flight control system that replaces traditional manual controls with computer-mediated signals for greater precision and reduced pilot workload
6. geared fan architecture	f. renewable or low-carbon fuel derived from sustainable sources to reduce greenhouse gas emissions in aviation
7. high-bypass ratio engine	g. a virtual model of a real aircraft or component used to simulate and optimise performance before and during its operational life

8. sustainable aviation fuel (SAF)	h. a transparent display that projects critical flight information into a pilot's line of sight, allowing them to keep their head up and eyes forward
9. glass cockpit	i. a type of jet engine where a large volume of air bypasses the engine core, improving fuel efficiency and reducing noise
10. head-up display (HUD)	j. a surveillance technology that broadcasts an aircraft's position, speed, and other data to air traffic control and nearby aircraft
11. traffic collision avoidance system (TCAS)	k. an onboard safety system that detects and warns pilots of potential mid-air collision risks and recommends avoidance manoeuvres
12. automatic dependent surveillance-broadcast (ADS-B)	l. an aircraft body built from advanced composite materials to reduce weight while maintaining strength and durability
13. digital twin technology	m. a strong, lightweight material made from carbon fibres embedded in a polymer resin, commonly used in aircraft construction
14. unmanned aerial system (UAS)	n. a turbofan engine configuration that uses a reduction gearbox to allow the fan and turbine to operate at their most efficient speeds independently
15. electric vertical take-off and landing (eVTOL) aircraft	o. a wing shape engineered to maintain smooth airflow over its surface, reducing drag and improving fuel efficiency

**4. Fill in the gaps with suitable terms and terminological combination and translate the text into Ukrainian**

*unmanned aerial systems (UAS), glass cockpit, remote air traffic control towers, geared fan architectures, additive manufacturing, carbon fibre-reinforced polymers, traffic collision avoidance systems (TCAS), hybrid-*

*electric propulsion systems, laminar flow wing designs, electric vertical take-off and landing (eVTOL) aircraft, enhanced ground proximity warning systems (EGPWS), high-bypass ratio configuration, performance-based navigation (PBN), digital twin technology, composite airframe structures, head-up display (HUD), sustainable aviation fuel (SAF), automatic dependent surveillance-broadcast (ADS-B), distributed electric propulsion systems, turbofan engines*

The aviation industry is entering an era of rapid transformation, driven by environmental regulations, digital innovation, and changing passenger expectations. Modern commercial aircraft increasingly feature (1) \_\_\_\_\_, replacing traditional analogue gauges with multifunction displays that integrate navigation, performance, and systems data in real time. Many cockpits also include a (2) \_\_\_\_\_, projecting essential flight information directly into the pilot's forward field of vision, reducing the need to look down at instruments.

From a design perspective, airframe manufacturers are turning to (3) \_\_\_\_\_ and (4) \_\_\_\_\_ to reduce structural weight without compromising strength. Combined with (5) \_\_\_\_\_, these innovations help minimise aerodynamic drag, thereby improving fuel efficiency and extending operational range.

Propulsion technology has also evolved significantly. The latest (6) \_\_\_\_\_ with (7) \_\_\_\_\_ deliver greater thrust-to-weight ratios, reduced fuel burn, and lower noise levels. Some models adopt a (8) \_\_\_\_\_ to increase efficiency, allowing a larger volume of air to bypass the engine core. Alongside these developments, airlines and engine manufacturers are investing in (9) \_\_\_\_\_, a renewable alternative to conventional jet fuel, to meet ambitious carbon reduction targets.

Safety enhancements remain a top priority. Modern aircraft are equipped with (10) \_\_\_\_\_, which warn pilots of potential mid-air collision threats and suggest avoidance manoeuvres. Additionally, (11) \_\_\_\_\_ technology allows aircraft to broadcast their position, altitude, and velocity to air traffic controllers and nearby aircraft in real time. On approach and landing, (12) \_\_\_\_\_ warn crews of dangerous terrain or obstacle proximity.

The rise of (13) \_\_\_\_\_ is one of the most exciting developments in urban air mobility, enabling rapid point-to-point travel in congested areas.

These aircraft typically use (14) \_\_\_\_\_ for quiet, efficient lift and thrust. Similarly, (15) \_\_\_\_\_ are increasingly deployed for cargo delivery, aerial mapping, and infrastructure inspection.

Aircraft development processes have been transformed by (16) \_\_\_\_\_, which create virtual replicas of real aircraft to simulate performance, test components, and optimise designs before physical production. Paired with (17) \_\_\_\_\_, such tools reduce production time and cost while improving quality control.

Air traffic management is undergoing its own evolution. (18) \_\_\_\_\_ procedures, supported by satellite navigation, enable more direct routing, reduced fuel use, and improved scheduling. In addition, (19) \_\_\_\_\_ are being introduced to modernise airport operations, with remote towers and digital control systems improving efficiency.

Looking to the future, hybrid propulsion concepts such as (20) \_\_\_\_\_ may bridge the gap between conventional engines and fully electric aircraft, reducing emissions on short- and medium-haul routes while maintaining operational flexibility.

## **5. Translate into English the following terms and terminological combinations**

авіаційна промисловість, реактивний двигун, турбовентиляторний двигун, гвинтовентиляторний двигун, гібридно-електрична силова установка, система управління польотом, система «fly-by-wire», композитна конструкція планера, полімер, армований вуглецевим волокном, аеродинамічна оптимізація, крило з ламінарним обтіканням, високий ступінь двоконтурності, редукторний вентилятор, сталий авіаційний паливний, система уникнення зіткнень, автоматичне залежне спостереження-трансляція, удосконалена система попередження зіткнення із землею, міська повітряна мобільність, літальний апарат з вертикальним зльотом і посадкою, розподілена електрична силова установка, безпілотна авіаційна система, кабіна зі скляними дисплеями, індикатор на лобовому склі, цифровий двійник, адитивне виробництво, навігація на основі характеристик, віддалена диспетчерська вежа, повітряне судно з нульовими викидами, паливна ефективність, дальність польоту.

## 6. Translate sentences into English paying attention to the underlined terms

1. Новий пасажирський літак оснащений **кабіною зі скляними дисплеями**, що забезпечує пілотам доступ до всієї інформації в реальному часі.

2. **Турбовентиляторний двигун** нового покоління має підвищений коефіцієнт тяга-вага та зменшений рівень шуму.

3. Використання **композитної конструкції планера** дозволило знизити масу літака на 15 %.

4. Для підвищення паливної ефективності конструктори застосували **крило з ламінарним обтіканням**.

5. У кабіні встановлено **індикатор на лобовому склі**, який проєктує дані польоту безпосередньо перед очима пілота.

6. Система **автоматичного залежного спостереження-трансляції** передає дані про місцезнаходження літака диспетчерам і іншим повітряним суднам.

7. Під час зниження **удосконалена система попередження зіткнення із землею** сигналізувала про небезпечне зближення з рельєфом.

8. Новий прототип **гібридно-електричної силової установки** призначений для регіональних авіарейсів.

9. Міська влада планує впровадити **лігальні апарати з вертикальним зльотом і посадкою** для швидких перевезень у центрі міста.

10. Інженери використали **технологію цифрових двійників** для тестування нової моделі літака перед початком виробництва.

## 7. Translate the following text into Ukrainian using all necessary lexical and grammatical transformations

The global aviation industry is undergoing a profound transformation, shaped by technological innovation, environmental regulations, and the growing demand for safer, cleaner, and more efficient air transport. Modern aircraft are far more than simple machines for moving passengers and cargo; they are complex systems that integrate cutting-edge aerodynamic

design, advanced propulsion technology, and sophisticated avionics suites to achieve optimal performance.

One of the most significant shifts in recent decades has been the move towards glass cockpit configurations. By replacing traditional analogue gauges with multifunction displays, pilots gain a centralised view of navigation, engine performance, weather, and flight systems. This digital integration is often complemented by a head-up display (HUD), which projects essential flight information directly into the pilot's forward field of vision, reducing the need to look down at the instrument panel.

In parallel, airframe construction has evolved dramatically. The use of composite airframe structures and carbon fibre-reinforced polymers has become a standard practice to reduce overall weight without sacrificing strength. These lightweight materials, when combined with laminar flow wing designs, help minimise drag, enhance fuel efficiency, and extend the operational range of aircraft. The result is a generation of airliners that consume less fuel per passenger-kilometre while offering improved environmental performance.

Propulsion systems have also seen remarkable advancements. Modern turbofan engines equipped with geared fan architectures offer improved thrust-to-weight ratios and quieter operations. Many designs incorporate a high-bypass ratio configuration, enabling a greater volume of air to bypass the engine core, which significantly reduces noise and fuel consumption. Alongside these developments, manufacturers are investing in sustainable aviation fuel (SAF), which can cut lifecycle greenhouse gas emissions by up to 80% compared to conventional jet fuel.

Safety remains the top priority in aviation, and modern technology has taken it to unprecedented levels. Aircraft are now equipped with traffic collision avoidance systems (TCAS), which monitor nearby air traffic and recommend avoidance manoeuvres. The introduction of automatic dependent surveillance–broadcast (ADS-B) has revolutionised aircraft tracking by broadcasting an aircraft's position, velocity, and altitude to air traffic controllers and other aircraft in real time. Additionally, enhanced ground proximity warning systems (EGPWS) provide pilots with alerts when terrain or obstacles pose a potential hazard during approach or landing.

Urban air mobility is emerging as one of the most promising areas of innovation. Electric vertical take-off and landing (eVTOL) aircraft are being developed to provide rapid, point-to-point transport in congested

cities. These aircraft typically rely on distributed electric propulsion systems for efficient, quiet, and environmentally friendly operations. At the same time, unmanned aerial systems (UAS) are becoming increasingly common in applications ranging from cargo delivery to infrastructure inspection and environmental monitoring.

Manufacturing processes have also been transformed by digitalisation. The use of digital twin technology allows engineers to create precise virtual models of aircraft, simulating structural performance, aerodynamics, and system behaviour before physical prototypes are built. Combined with additive manufacturing techniques, which produce parts layer by layer from digital designs, this approach reduces production costs, shortens development cycles, and improves quality control.

Air navigation and air traffic management are also evolving. Performance-based navigation (PBN) enables more direct and efficient routing by using advanced satellite navigation systems. This reduces fuel consumption, shortens flight times, and allows aircraft to operate safely in challenging terrain or congested airspace. Airports are adopting remote air traffic control towers, where controllers use high-definition video feeds and sensor data to manage traffic from off-site locations, increasing operational flexibility and reducing infrastructure costs.

Looking to the future, the development of hybrid-electric propulsion systems could bridge the gap between conventional jet engines and fully electric aircraft, offering a practical solution for reducing emissions on short- and medium-haul routes. Advances in battery technology, hydrogen fuel cells, and lightweight structural materials will play a critical role in this transition. Furthermore, vehicle-to-everything (V2X) communication could allow aircraft to exchange data with other aircraft, air traffic control, and ground infrastructure, creating a fully connected aviation ecosystem.

The next two decades promise to be a defining period for the aviation industry. The convergence of electrification, automation, and digital connectivity is likely to result in aircraft that are cleaner, quieter, and more intelligent than anything seen before. With continued investment in sustainable technologies and advanced manufacturing methods, aviation can meet the dual challenge of expanding global mobility while reducing its environmental footprint. In this future, passengers will not only travel faster and more efficiently, but also with the knowledge that their journeys contribute to a more sustainable world.

## 8. Translate the following texts into English using all necessary lexical and grammatical transformations

Over the last decade, the aviation sector has faced a dual challenge: maintaining operational efficiency while adapting to increasingly stringent environmental standards. This shift has been accelerated by international agreements such as the ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) and the European Union's "Fit for 55" initiative. As a result, manufacturers have been forced to reconsider almost every aspect of aircraft design, from **aerodynamic configurations** to **propulsion technologies**, and from **air traffic management procedures** to **fuel supply chains**.

One of the most striking developments has been the integration of **advanced composite materials** into **airframe construction**. By replacing traditional aluminium alloys with **carbon fibre-reinforced polymers** and **glass fibre composites**, engineers have achieved significant reductions in structural weight, which directly translate into lower fuel consumption, reduced greenhouse gas emissions, and extended operational range. These materials are not only lighter but also more resistant to fatigue and corrosion, resulting in lower maintenance costs over the aircraft's lifespan. Furthermore, innovations in **laminar flow wing designs** help to minimise drag, enabling more efficient cruising at optimal altitudes and reducing the need for excessive thrust.

**Propulsion systems** have undergone equally significant modernisation. Contemporary **turbofan engines** often employ **geared fan architectures**, which allow the fan and turbine to operate at their most efficient speeds, as well as a **high-bypass ratio configuration**, which moves a greater volume of air around the engine core rather than through it. This results in substantial noise reduction and improved fuel efficiency. At the same time, the adoption of **sustainable aviation fuel (SAF)** – produced from renewable sources such as waste oils, biomass, and even captured CO<sub>2</sub> – is gaining momentum. SAF can be used as a "drop-in" replacement for conventional jet fuel, meaning it requires no modification to existing engines or fuel infrastructure, making it an attractive option for near-term decarbonisation.

Safety, however, remains the industry's most uncompromising priority. Modern airliners are fitted with an extensive array of automated safety systems. **Traffic collision avoidance systems (TCAS)** provide real-time

alerts and suggest evasive manoeuvres to prevent mid-air collisions, while **enhanced ground proximity warning systems (EGPWS)** monitor terrain data to prevent controlled flight into terrain (CFIT) accidents. **Automatic dependent surveillance–broadcast (ADS-B)** has revolutionised aircraft tracking by broadcasting an aircraft’s position, altitude, and velocity to air traffic controllers and other aircraft in real time, dramatically improving situational awareness and traffic flow management.

In addition to passenger aircraft, the rise of **urban air mobility** is reshaping the aviation landscape. **Electric vertical take-off and landing (eVTOL) aircraft**—often powered by **distributed electric propulsion systems**—are being developed to operate in densely populated cities, providing rapid, on-demand point-to-point transport. These aircraft promise quieter operations, lower emissions, and reduced congestion compared to conventional ground transportation. However, their integration into existing airspace will require new regulatory frameworks, air traffic management strategies, and urban infrastructure such as charging stations and designated vertiports.

Technological innovation is also revolutionising aircraft manufacturing. The use of **digital twin technology** allows engineers to create detailed virtual replicas of aircraft systems, enabling them to simulate structural loads, aerodynamic performance, and system behaviour long before physical prototypes are built. Coupled with **additive manufacturing**, which fabricates components layer by layer from digital designs, this approach reduces production costs, minimises waste, and allows for rapid prototyping of complex geometries that would be impossible to produce using conventional machining methods.

Air navigation and air traffic management are adapting to accommodate increasing air travel demand. **Performance-based navigation (PBN)** enables aircraft to follow more precise and efficient flight paths using satellite-based positioning systems rather than relying solely on ground-based beacons. This not only shortens flight times and reduces fuel burn but also allows for safe operations in challenging terrain or congested corridors. Additionally, some airports are implementing **remote air traffic control towers**, where controllers manage aircraft movements via high-definition cameras and sensor feeds from locations hundreds of kilometres away, improving cost efficiency and operational flexibility.

Looking to the future, **hybrid-electric propulsion systems** are emerging as a transitional technology between conventional jet engines and

fully electric aircraft. These systems use a combination of turbine generators and electric motors to reduce fuel consumption and emissions, particularly on short- and medium-haul routes. Advances in **battery energy density**, **hydrogen fuel cell technology**, and **lightweight structural materials** will further accelerate the shift towards sustainable aviation. Another promising development is **vehicle-to-everything (V2X) communication**, which could allow aircraft to exchange data not only with air traffic control but also with other aircraft, airport systems, and even ground-based infrastructure, creating a fully integrated and responsive aviation ecosystem.

Despite the promising outlook, the path to sustainable aviation will not be without challenges. The industry must balance technological ambition with economic viability, ensuring that innovations are both scalable and affordable. Moreover, the global nature of aviation means that progress will require unprecedented cooperation between governments, regulatory agencies, manufacturers, and operators. Yet, if these challenges can be met, the result will be a cleaner, quieter, and more connected future for air travel – one that meets the needs of passengers while protecting the planet for generations to come.

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