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Навчальний посібник «Професійна англійська для цивільної інженерії» розрахований на здобувачів закладів вищої освіти і спрямований на ґрунтовне засвоєння англійської мови за професійним спрямуванням.

Зміст посібника відповідає вимогам навчального плану та нової концепції викладання фахової англійської мови в закладах вищої освіти України. Посібник розроблений так, щоб своєю структурою і проблематикою орієнтувати здобувачів на системну організацію навчального процесу та бути складовою частиною комплексу навчальних матеріалів з англійської мови для здобувачів закладів вищої освіти з дисципліни «Іноземна мова за професійним спрямуванням»

Perelyhina O. I.

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The tutorial on the subject “Professional English for Civil Engineering” is produced for students of higher educational institutions and is aimed at a substantive knowledge of English in a professional field.

The content of the textbook corresponds to the requirements of the curriculum and the new teaching concept of professional English language instruction in Ukrainian higher education institutions. The textbook is developed in a way that its structure and content guide students towards a systematic organization of the learning process and serve as an integral component of the educational materials in English for higher education students in the discipline of 'Foreign Language for Professional Purposes.

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CONTENTS

ПЕРЕДМОВА

Запропонований посібник призначений для здобувачів будівельних спеціальностей технічних вишів, архітекторів, науковців та всіх, хто бажає удосконалити англійську мову за цим напрямом.

Посібник містить 16 розділів. З урахуванням принципу методичної доцільності тексти до кожного розділу подано в оригінальному форматі. Унікальність запропонованого посібника полягає в тому, що він, окрім традиційної когнітивної функції (мовної та професійної компетенцій), спрямований також і на розвиток особистостісних якостей здобувача, соціальних компетентностей, мислення – навичок опрацювання інформації, її узагальнення. Реалізація цього підходу уможливила вирішення низки організаційних, наукових, дидактичних та змістових завдань, а саме:

1. Орієнтування на реформування української освіти в рамках Болонського підходу, що передбачає переструктурування навчальних програм за принципами кредитно-модульної системи, забезпечення чіткої модульної структури підручника відповідно до вимог цього підходу.

2. Орієнтування на розвиток мовних компетентностей здобувачів обумовило використання інтегрованого підходу, що забезпечує розвиток практично всіх видів мовленнєвої діяльності – читання: оглядове, пошукове й вивчальне; мовлення: монологічне й діалогічне; письмо – та охоплює такі аспекти мови, як фонетика, граматика й лексика, за допомогою системи інтерактивних завдань.

3. Ефективність навчального процесу забезпечується базуванням на результатах багаторічних наукових досліджень, які були експериментально перевірені та впроваджені в реальних умовах навчання у ЗВО. Ці результати відображені у монографіях, статтях та програмах AI, MT, NLP, що мають міжнародне визнання. Система завдань враховує психологічні вимоги, які стосуються функціонування пам’яті і мислення людини. Граматична компетентність формується на підставі психологічних механізмів створення та сприйняття мовних висловлювань. Комплексний розвиток здобувачів

здійснюється з урахуванням психологічних закономірностей розвитку особистості.

4. Усі завдання посібника проблемні та спрямовані на розвиток навичок, необхідних у реальних життєвих ситуаціях. Варто зауважити, що універсально сформульовані завдання потребують індивідуального підходу під час їх виконання, оскільки обумовлюються досвідом кожного окремого здобувача. Запропонована методика дозволяє виявити розбіжності між поточним та необхідним рівнями розвитку, таким чином визначаючи зону індивідуального росту для кожного здобувача.

5. Посібник можна використовувати як під час занять в аудиторії, так і для самостійної роботи. З метою забезпечення ефективності самостійного навчання у підручнику подано детальні дидактичні рекомендації, які чітко визначають послідовність дій, необхідних для виконання завдань; глосарій; слова та вирази для формулювання гіпотез, анотацій, рефератів, критичних оглядів та інших текстів.

6. Зосередження на міжнародному рівні розвитку професійних компетентностей здобувачів визначило зміст текстів, які відображають сучасні передові технології у галузі, що вивчається.

7. Орієнтація на розвиток мислення здобувачів визначила зміст проблемних завдань, структурованих так, щоб їх регулярне виконання сприяло автоматизації навичок обробки інформації, узагальнення та використання її для розв’язання реальних проблем.

8. Орієнтування на розвиток соціальних компетентностей, окрім осмислення крос-культурних відмінностей і формування свідомості щодо власної ідентичності, передбачає розвиток навичок комунікування у форматі діалогу та колективної роботи з відповідним лінгвістичним забезпеченням усього процесу взаємодії.

UNIT 1

Careers in Civil Engineering

Activity 1: Match A and B to make the word combinations

A	B
civil	trend
engineering	agency
to solve	subjects
amount of	traffic
technical	the problem
current	engineering
soil	engineers
experts in	skill
water	a project
team of	stabilization
large	a highway
work on	resources
theoretical	knowledge
construction of	choice
administrative	design
government	curriculum

Write down the word combinations into the box

Activity 2: Read the text given below

Engineering is a profession, which means that an engineer must have a specialized university education. In the university, mathematics, physics, and chemistry are heavily emphasized throughout the engineering curriculum, but particularly in the first two or three years. Mathematics is very important in all branches of engineering, so it is greatly stressed. Today, mathematics includes courses in statistics, which deals with gathering, classifying, and using numerical data, or pieces of information. An important aspect of statistical mathematics is probability, which deals with what may happen when there are different factors, or variables, that can change the results of a problem**.** Before the construction of a bridge is undertaken, for example, a statistical study is made of the amount of traffic the bridge will be expected to handle.

Because a great deal of calculation is involved in solving these problems, computer programming is now included in almost all engineering curricula. Computers, of course, can solve many problems involving calculations with greater speed and accuracy than a human being can. But computers are useless unless they are given clear and accurate instructions and information – in other words, a good program. In spite of the heavy emphasis on technical subjects in the engineering curriculum, a current trend is to require students to take courses in the social sciences and the language arts.

You know there is a relationship between engineering and society; it is sufficient, therefore, to say again that the work performed by an engineer affects society in many different and important ways that he/she should be aware of. An engineer also needs a sufficient command of language to be able to prepare reports that are clear and, in many cases, persuasive. Engineering is a profession, which means that an engineer must have a specialized university education. The last two years of an engineering program include subjects within the student’s field of specialization. For the student who is preparing to become a civil engineer, these specialized courses may deal with such subjects as geodetic surveying, soil mechanics, or hydraulics.

Active recruiting for engineers often begins before the student's last year in the university. Many different corporations and government agencies have competed for the services of engineers in recent years. In the science-oriented society of today, people who have technical training are, of course, in demand. Young engineers may choose to go into environmental or sanitary engineering, for example, where environmental concerns have created many openings; or they may choose construction firms that specialize in highway work; or they may prefer to work with one of the government agencies that deal with water resources. Indeed, the choice is large and varied.

When the young engineer has finally started actual practice, the theoretical knowledge acquired in the university must be applied. He/she will probably be assigned at the beginning to work with a team of engineers. Thus, on-the-job training can be acquired that will demonstrate his/her ability to translate theory into practice to the supervisors.

The civil engineer may work in research, design, construction supervision, maintenance, or even in sales or management. Each of these areas involves different duties, different emphases, and different uses of the engineer's knowledge and experience. Research is one of the most important aspects of scientific and engineering practice. A researcher usually works as a member of a team with other scientists and engineers. He/she is often employed in a laboratory that is financed by government or industry. Areas of research connected with civil engineering include soil mechanics and soil stabilization techniques, and also the development and testing of new structural materials.

We noted that civil engineering projects are almost always unique; that is, each has its own problems and design features. Therefore, careful study is given to each project even before design work begins. The study includes a survey of both topographical and subsoil features of the proposed site. It also includes a consideration of possible alternatives, such as a concrete gravity dam or an earth-fill embankment dam. The economic factors involved in each of the possible alternatives must also be weighed. Today, a study usually includes a consideration of the

environmental impact of the project. Many engineers, usually working as a team that includes surveyors, specialists in soil mechanics, and experts in design and construction, are involved in making these feasibility studies.

Many civil engineers, among them the top people in the field, work in design. Civil engineers work on many different kinds of structures, so it is normal practice for an engineer to specialize in just one kind. In designing buildings, engineers often work as consultants to architectural or construction firms. Dams, bridges, water supply systems, and other large projects ordinarily employ several engineers whose work is coordinated by a systems engineer who is in charge of the entire project. In many cases, engineers from other disciplines are involved. In a dam project, for example, electrical and mechanical engineers work on the design of the powerhouse and its equipment.

Construction is a complicated process on almost all engineering projects**.** It involves scheduling the work and utilizing the equipment and the materials so that costs are kept as low as possible. Safety factors must also be taken into account, since construction can be very dangerous. Many civil engineers therefore specialize in the construction phase. After the structure has been completed, it must be kept from falling into disrepair; therefore, many engineers specialize in maintenance. This is often a function of the privately owned utility or governmental agency that will ultimately be responsible for the completed structure. Companies that supply products or equipment for construction often employ civil engineers as part of their sales staff. The customers are engineers themselves; and so, they must be given the opportunity to communicate with sales people who can understand the same technical specifications. A few engineers may also go into management – the establishment or carrying out of the policies of the companies that employ them.

Construction companies are often headed by civil engineers**;** indeed, some of these companies were founded by engineers. No matter what the path into management may be, these engineers must have administrative as well as technical skills. Many civil engineers work for government agencies; many others work as consultants, providing their knowledge and experience to solve problems in their

field. Since the building of a structure is ordinarily a unique endeavor, consulting is a particularly common practice among civil engineers. A successful consulting engineer must have a wide range of experience and knowledge, as well as the ability to work easily with other people.

Activity 3: Answer the question to the text

1. What subjects are very important for civil engineers?
2. In what ways can computers help them?
3. What is the relationship between engineering and society*?*
4. Why do civil engineers work as consultants to architectural firms?
5. What is one of the most important aspects of scientific practice?
6. Why is it said that construction is a complicated process?
7. What utilities specialize in maintenance?
8. What skill must engineers have today?
9. May engineers go into management? What kind of management can it be?

Activity 4

Step 1: Write an abstract to the text and retell it

Step 2: Resume the text in a few sentences starting with:

This text is about ……

The main attention is given to ……

It can be interesting for …….

1.1 Grammar focus

Step 1: Revision of the rules

Table 1.1 – present times

Present Simple, Present Continuous, Present Perfect / Perfect Continuous		
I, we write / He, she write**s** **Do** you write? / **Does** he write? They **don't** write / He **doesn't** write (often, usually, rarely, sometimes, always)	– habits; – how often something happens; – general truth/facts	Toby **usually** walks to work. Angela doesn't visit us **very often**. Poland is in the European Union
I am read**ing /** We (you, they) **are** read**ing** He (she, it) **is re**ading **Are** you reading? Is he speaking? I'm **not** smoking She is **not** writing (now, still, at the moment)	– actions happening now; – temporary situation; –changing situation; – annoying habits (with **always**)	Mike is driving to work **at the moment**. Are they staying in the hotel near the station? Holidays abroad are becoming popular. Dad is **always** cleaning the car when I want to use it!
I **have** work**ed /** He **has** done **(III)** **Have** you finish**ed**? / **Has** he got? You **have not** worked / She **has not** written (already, just, ever, never, yet, since, for)	– situations started in the past and are still true; – personal experience; – result of completed action	She has had her motorbike **for six years**. Have you **ever** flown in the helicopter? I've booked the coach tickets
I **have been** do**ing** He **has** been do**ing** **Have** you been doing…? **Has** he been doing…? They have **not** been doing… (since Monday, for two hours already)	– actions continuing up to the present moment; – actions stopping just before the present moment	We have been driving **for hours**! Can't we have a break soon? I'm out of breath because I've been running to get there in time

Step 2:

a) Put the verb into the Present Simple or Present Continuous

1. They (to solve) ….. the problem tomorrow.
2. He (to make) ….. calculations very often.
3. He (to write) ….. a project at the moment.

4. Ann (to work) ….. as a consultant.

5. Ann (to work) ….. as a leader of the project next year.

6. You (to have) ….. any administrative skills?

7. You (to make) ….. a research next month?

8. She (to pass) ….. professional tests every year?

9. She (to pass) ….. her professional test at the moment.

10. What field you (to specialize) ….. now?

в) Put the verbs into Present Perfect and explain the rule from the box

1. I (be)….. in Paris.

2. I think the director (leave)….. the town.

3. We (know) ….. her since she arrived to our city.

4. I (forget)….. her name.

5. He (close) ….. the door?

6. He (not bring) ….. many papers.

7. They (leave)….. the city this month?

8. He (write) ….. his name on my book.

9. She……just (come) …….

10. I (get) ….. a long letter from father this week.

c) Put the verb in brackets into the correct form

1. Ian (to take) ……. shower. Could you call back in about half an hour?

2. I (to write) …… to all the local newspapers to complain.

3. Eric, (to play) usually hockey competitively or just for fun?

4. That's the first time I (to get) ….. an answer right today!

5. Where have you been? I (to look for) …. for you for the last half hour.

6. Jessica (to leave) ….., I'm afraid.

7.Dan (to sleep) in the living room while we redecorate his bedroom.

8. Unfortunately Simone (to get) ….. a day-off not very often.

9. You (to go) to Ipswich before?

10. I think, Darren (to work) ….. hard sometimes.

Glossary

Abbreviations: **adj.** = adjective – прикметник; **adv.** = adverb – прислівник; **pl.** = plural – множина; **pp.** = past participle – дієприкметник; **n.** = noun – іменник; **v.** = verb – дієслово

accuracy *(n)*	точність
be available *(v)*	бути в наявності
be in charge *(v)*	ставити в обов'язок
be in demand *(v)*	мати попит
be responsible for *(v)*	бути відповідальним
gravity dam *(n)*	гравітаційна дамба
construction *(n)*	будівництво
curriculum *(n)*, curricula (*pl)*	навчальний план
deal with *(v)*	мати справу / відношення /відносини
design *(n, v)*	проєкт, проєктувати
dexterity *(n)*	*тут* спритність
duties *(n)*	службові обов'язки
earth fill embankment dam *(n)*	земляна дамба
endeavor *(n)*	спроба
environmental *(adj)*	що належить до довкілля
fall into disrepair	приходити у зношений стан
feasibility study *(n)*	вивчення можливості проєкту
feature *(n)*	особливість
findings *(n, pl)*	отримані дані, здобуті відомості
free-hand drawing	малюнок від руки
geodetic surveying *(n)*	геодезичне знімання
maintenance *(n)*	обслуговування, експлуатація
on-the-job training *(n)*	підготовка на робочому місці
opening *(n)*	вакансія
persuasive (*adj)*	переконливий
probability *(n)*	теорія вірогідності
recruit *(v)*	укомплектовувати робочою силою
research *(n, v)*	дослідження, досліджувати
scheduling *(n)*	календарне планування
skill *(n)*	навичка, уміння
soil mechanics *(n)*	механіка ґрунтів
supervision *(n)*	керівництво, нагляд
surveyor *(n)*	геодезист, топограф
team *(n)*	команда, група

UNIT 2

Careers in Housing

Activity 1:
Finish the following sentences with the names of jobs and professions given below

Property manager Model maker Journeyman Architectural drafter Mason Building inspector Building contractor Architectural illustrator Construction technologist

1. …… interviews prospective tenants, maintains the property, and reports to the building owner.

2. …… makes tracings from the original drawings prepared by the architect or the designer.

3. …… prepares presentation drawings, sketches, and illustrations for advertising and for client presentations.

4. ……. is responsible for scheduling work, obtaining materials and equipment, and making sure that materials and construction comply with building codes.

5. ……. builds scale models of objects, such as planned communities, individual buildings, pieces of furniture, or room layouts.

6. ……. examines construction in progress to verify that local codes are followed.

7. ……. is a worker, skilled in a given building trade or craft, who has successfully completed an official apprenticeship qualification.

8. ……. is a professional skilled in cutting, dressing, and laying stone in buildings.

9. ……. is responsible for estimating and bidding, quality control, site supervision, specifications writing, expediting, purchasing, and managing construction.

Activity 2: Read the text given below

There are numerous professionals involved with housing construction. They generally fall into three career categories: planners and designers, building tradespeople, and allied professionals.

Planners and Designers. Long before a building is built, planners and designers are hard at work developing the plans for it. These occupations usually require creative ability and problem-solving skills as well as knowledge and training in housing design. Planners and designers include: architects, architectural drafters, architectural illustrators, interior designers, model makers, and landscape designers.

The architect's job requires sensitivity to forms and materials. An architect must have a thorough understanding of construction technology, building codes, laws pertaining to construction, and the use of modern CAD equipment. The architect works closely with a client, making preliminary sketches, suggesting materials, and helping a client to choose a satisfactory final design for a structure. Working drawings are then prepared. The architect may also help the client to choose a building contractor and represent the client during construction. To become a registered architect, a person must fulfill the educational training requirements for that state. In addition, all states require an examination to obtain a license. Most states require at least a bachelor's degree from a college with an accredited architecture program.

Architectural Drafters draw the details of working drawings and make tracings from the original drawings prepared by the architect or designer. They often begin as junior drafters. As they gain experience, they may move into drafting positions requiring more responsibility. An architectural drafting position usually requires at least a high school diploma with some courses in architectural drawing and CAD.

Architectural illustrators need a high degree of artistic skill to be readily employable. They usually begin study in architectural drawing or commercial art and then branch into this specialized field. They prepare presentation drawings, sketches, and illustrations for advertising and for client presentations. Much of the work today

is performed on a CAD system. A natural talent for freehand drawing is important because of the artistic nature of this work.

Interior designers plan and supervise the design and decoration of building interiors. Creativity and a full knowledge of design principles, materials, furnishings, and accessories are needed for this type of work. They work with clients to choose furnishings and materials that will meet the clients' needs and tastes. They may select, estimate the costs and arrange purchases of furniture, floor and wall coverings, and other needed items.

Model makers build scale models of objects, such as planned communities, individual buildings, pieces of furniture, or room layouts. Model making requires an ability to read drawings and a thorough knowledge of materials. The model maker must also be creative and skilled in operating machinery used to make models. There are no special educational requirements for this job; however, much experience and manual dexterity is needed.

The landscape designer plans the arrangement and composition of landscape elements on a site. This involves working with clients to prepare a design plan, selecting landscape materials, and supervising the installation of elements. Landscape designers need a thorough knowledge of soil, plants, design, and construction. They generally have a bachelor's degree.

Building Tradespeople. The second large category of jobs related to housing construction involves numerous people, including building contractors, construction technologists, skilled tradespeople, and construction machinery operators.

Building contractors plan and coordinate the construction of buildings. This may involve working with or supervising subcontractors, inspectors, and designers. Contractors are responsible for scheduling work, obtaining materials and equipment, and making sure that materials and construction comply with building codes. A contractor must obtain a license to do contracting work.

Construction technologists are qualified for both technical and supervisory roles. Specialty areas within construction technology include estimating and bidding, quality control, site supervision, specifications writing, expediting, purchasing, and

managing construction. A construction technologist typically has a bachelor's degree in construction technology. A strong science background and knowledge of construction are needed for this category.

Skilled tradespeople perform specific jobs involved in construction. They include carpenters, masons, electricians, plumbers, painters, and paperhangers. Three positions, designated by skill and experience, are recognized in most trades: apprentice, journeyman, and master.

Many large, expensive machines, such as cranes, bulldozers, excavators, and forklifts, are used in modern construction.

Construction machinery operators are needed to run machines safely and efficiently. Machine operators take care of all machine-specific functions such as configuring the equipment, loading and operating the machines, and optimizing the machine capability. They need to ensure that the machine works at its full capacity, oversee its maintenance, and perform timely quality checks.

Land surveyors locate property boundaries, measure distances, establish contours, and make drawings of the site surveyed. Computer expertise is expected. Land surveying is highly technical work requiring skill in trigonometry and drawing.

Allied Carriers. Government and real estate positions are also related to housing. They require knowledge and skills outside of the housing field as well as a general knowledge of housing fundamentals.

Government Positions. Many positions in local, state, and federal government relate to the housing industry. Building inspectors examine construction in progress to verify that local codes are followed. Inspection covers nearly all materials, equipment, and workmanship on a construction site.

Real estate positions. Several careers are possible in the field of real estate. The real estate agent assists people in buying, selling, and renting property. Brokers are professionals that must know building codes and laws relating to real estate transactions. Real estate management is another career in the field of real estate. Large housing units often employ property managers. Management duties involve

interviewing prospective tenants, maintaining the property, and reporting to the building owner.

Activity 3: Answer the question to the text

1. What professionals are involved with housing construction?
2. What does the architect do?
3. Who plans and supervises the design and decoration of building interiors?
4. What does the landscape designer do?
5. What machines are used in modern construction?
6. What do machinery operators need to ensure?
7. What skilled tradespeople perform specific jobs in construction?
8. Who assists people in buying, selling and renting property?
9. What do management duties involve?

Activity 4

Step 1: Write an abstract to the text and retell it

Step 2: Resume the text in a few sentences starting with

This text is about ……
The main attention is given to ……
It can be interesting for …….

2.1 Grammar focus

Step 1: Revision of the rules

Table 2.1 – past times

Past times: Past Simple, Past Continuous, Past Perfect		
I, he, we work**ed** I, he, we **wrote (II)** **Did** he work? They **did not** write (yesterday, last week, long ago, a year ago)	– single completed actions; – habits in the past; – permanent situations in the past	Tom and I **played** the game of chess and he **won**. **Did** you **collect** stamps when you were younger? A famous football player **lived** in our house before
I, he, it **was** doing We, they, you **were** riting **Was** he doing? **Were** you writing? He **was not** doing They **were not** writing (from 2 till 5 yesterday)	– actions happening at the particular moment in the past; – actions in progress over a period of time; – two actions in progress at the same time	At 5 o'clock I **was reading** a new book. Daniel **was playing** video games all morning yesterday. They **were playing** games while we **were talking**
I, he, we **had** work**ed** I, he **had** done **(III)** **Had** you work**ed**? They **had not** done it (before they came, by three o'clock)	– situation and states before the past; – completed actions before a moment in the past	We **had lived** next to the gym for a month before I joined. The party **had** already **begun** when I arrived

a) Put the verb into the Past Simple or the Present Perfect Tense

1. I (meet) ….. my contractors today.
2. A month ago my uncle (finish)….. a new house in the country.
3. He (forget) ….. to make some calculations when he (write) …… the report.
4. I (prepare) ….. several draft projects this week.
5. She (go) ….. to the site an hour ago.
6. When ……. the construction of that development (begin) ……?
7. The land surveyor (not come) ….. to the site yet.
8. The situation (not change) ….. since yesterday.
9. He (be) responsible for the interior …… last year.
10. When you last (have) …… on-the-job training?

в) Put the verb in brackets into the correct form

1. We (to have the meeting) …… when the client (to come) …… to the room.
2. The technologist (to estimate) ….. the site when we (to see) ….. the problem.
3. He was busy. He (not\ to draw) …… the details of the draft.
4. They (to load) …… the equipment when the lorry (to break) …… down.
5. I (to interview) …… the prospective tenants. The manager (to ask) …… a question, so I (to interrupt) …… the interview.
6. What (you\to do) …… on Saturday evening? – I (to prepare) …… the final drafts of the building.
7. What (you\to do) …… at 9.30 on Monday evening? – I (to read) …… an article about modern technologies.

c) Put the verb into the Past Perfect Tense and translate the sentences into Ukrainian

1. She was a stranger to me. I (never / to see) ….. her before.
2. We came to the meeting late. The presentation (already\to begin) …… .
3. She (to built) scale models of the object by the beginning of the meeting.
4. They were very happy. They (just\to find)…… an appropriate place for construction.
5. The construction site was empty when the engineer came. Everybody (to go) ……. home.
6. The architect (to check) all the details of the preliminary sketches before he called the client.
7. The contractor (to obtain a license) ……. before he applied to the vacant position.

Glossary

Abbreviations: **adj.** = adjective – прикметник; **adv.** = adverb – прислівник; **pl.** = plural – множина; pp. = past participle – дієприкметник; **n.** = noun – іменник; **v.** = verb – дієслово

apprentice *(n)*	учень
artistic *(adj)*	художній
background *(n)*	підготовка
bid *(v)*	пропонувати ціну
branch into *(v)*	спеціалізуватися у
carpenter *(n)*	тесляр
code *(n)*	закон, норматив
comply with*(v)*	відповідати чому-небудь
contractor *(n)*	підрядник
crane *(n)*	підіймальний кран
creative *(adj)*	творчий
dexterity *(n)*	здібності /здатності
drafter *(n)*	кресляр
drawing *(n)*	креслення
estimate *(v)*	оцінювати
forklift *(n)*	вантажопідіймач
freehand *(adj)*	вільний, легкий
furnishing *(n)*	меблі, інтер'єр
journeyman *(n)*	кваліфікований робітник
land surveyor*(n)*	топограф геодезист
landscape *(n)*	ландшафт
layout *(n)*	планування, план
mason *(n)*	муляр
painter *(n)*	маляр
paperhanger*(n)*	шпалерник
plumber *(n)*	водопровідник
purchase *(n)*	купівля
real estate *(n)*	нерухомість
scale *(n)*	масштаб
schedule *(v)*	планувати
sewer *(n)*	каналізація
sketch *(n)*	ескіз
skill *(n)*	майстерність
soil *(n)*	ґрунт
supervise *(v)*	наглядати
tenant *(n)*	мешканець
tracing *(n)*	калька
verify *(v)*	перевіряти

UNIT 3

Institution of Civil Engineers

Activity 1: Fill in the gaps and translate the sentences into Ukrainian

non-profit	membership	subscription	appointment	investigation	ensure
headway	oversee	in addition to	possess	adaptation	occasionally

1. Evolution occurs as a result of …… to new environment.
2. The bank conducted its own internal …… into the robbery.
3. I'm trying to learn to drive, but I'm not making much …… with it.
4. We're going to give up our sports club ……. after this year.
5. If he didn't have a secretary to remind him, he wouldn't keep any of his …….
6. Your business can be listed on the website for low monthly ……. .
7. We must ……. that tourism develops in harmony with the environment.
8. She is a fitness instructor ……. being a full-time student.
9. We are trying to bring out the artistic talents that many people ……. without realizing it.
10. We are a ……. organization dedicated to the conservation of ocean mammals.
11. She only sees her niece …….., so she showers her with presents when she does.
12. As marketing manager, her job is to …….. all the company's advertising.

Activity 2: Read the text given below

The Institution of Civil Engineers (ICE) was founded in 1818. It is an independent professional association representing civil engineers. The Institution of Civil Engineers is based in central London. Like its early membership, the majority

of its current members are British engineers, but it also has members in more than 100 countries around the world. In 2007, its total membership stood at around 75,000. Professional body or association is an organization, usually non-profit, that exists to further a particular profession, to protect both the public interest and the interests of professionals. Many professional bodies perform professional certification to indicate a person possesses qualifications in the subject area, and sometimes membership in a professional body is synonymous with certification, but not always. Sometimes membership in a professional body is required for one to be legally able to practice the profession. Many professional bodies also act as learned societies for the academic disciplines underlying their professions.

As a professional body, the Institution of Civil Engineers is committed to support and promote professional learning (both to students and existing practitioners), managing professional ethics and safeguarding the status of engineers, and representing the interests of the profession in dealings with government, etc. It sets standards for membership of the body; works with industry and colleges or universities to progress engineering standards and to advise on education and training curricula; publishes technical studies of aspects of civil engineering, and publishes a weekly magazine, the New Civil Engineer.

New Civil Engineer is the weekly magazine of the Institution of Civil Engineers, the UK chartered body that oversees the practice of civil engineering in the UK. Available in print and online after the appropriate subscription has been taken out (it is free for members of the ICE), the magazine is aimed at professionals in the civil engineering industry. It contains news from the industry, analysis of recent news and issues, letters from subscribers, a directory of companies, with listings arranged by the company's area of work, and an appointments section. It also occasionally has details of university courses and graduate positions.

Students pursuing recognized academic courses in civil engineering can join the ICE as student members. After completing their studies, individuals can become graduate members – a step closer to achieving full Member status (MICE). The pinnacle of professional standing is to then be accepted as a Fellow (FICE).

The late 18th century and early 19th century saw the founding of many learned societies and professional bodies, for example, the Royal Society and the Law Society. The Royal Society is a learned society for science that was founded in 1660 and is the oldest such society still in existence. Groups calling themselves civil engineers had been meeting for some years from the late 18th century. Notably the Society of Civil Engineers was formed in 1771 by John Smeaton, one of greatest British engineers. John Smeaton was a civil engineer and is known as the "father of civil engineering". He was responsible for the design of many bridges, canals, harbours and lighthouses including the famous Eddystone Lighthouse. He was also an eminent physicist and a mechanical engineer. His role in civil engineering is very important because his work led to the invention of Portland cement. The society was renamed the Smeatonian Society after his death. However, apart from groups centred upon universities and other centres of learning, there was no body promoting the profession of civil engineering.

The initiative to found the Institution was taken in 1818 by three young engineers, Henry Robinson Palmer (23), James Jones (28) and Joshua Field (32), who organized an inaugural meeting on 2 January 1818, at the Kendal Coffee House in Fleet Street. The institution made little headway until a key step was taken – the appointment of Thomas Telford as the first President of the body. Greatly respected within the profession and blessed with numerous contacts across the industry and in government circles, he was instrumental in drumming up membership and getting a Royal Charter for ICE in 1828. The Royal Charter is a signed document from a king or a queen which allows a town, organization, or university to officially exist and have special rights. This official recognition helped establish ICE as the preeminent organization for civil engineers. Civil engineers who have successfully completed special examinations become chartered engineers.

The objects of such institution, as recited in the charter, were

“»he general advancement of mechanical science, and more particularly for promoting the acquisition of that species of knowledge which constitutes the profession of a civil engineer; being the art of directing the great sources of power in

nature for the use and convenience of man, as the means of production and of traffic, both for external and internal trade, as applied in the construction of roads, bridges, aqueducts, canals, river navigation, and docks, for internal intercourse and exchange; and in the construction of ports, harbours, moles, breakwaters, and lighthouses, and in the art of navigation by artificial power, for the purposes of commerce; and in the construction and adaptation of machinery, and in the drainage of cities and towns».

After Telford's death in 1834, the organization moved into premises in the heart of Westminster in 1839, and began to publish learned papers on engineering topics. Its members, notably William Cubitt, were also prominent in the organization of the Great Exhibition of 1851. By the end of the 19th century, ICE had introduced examinations for professional engineering qualifications to help ensure and maintain high standards among its members. Many of the profession's greatest engineers served as President of the ICE. In November 2007, David Orr assumed office as the current President.

Today the Institution continues its role for maintaining high standards. Also, it makes a series of awards to recognize the work of its members. In addition to awards for technical papers, reports and competition entries it awards a number of medals for different achievements. For example, the Gold Medal is awarded to an individual who has made valuable contributions to civil engineering over many years. This may cover contributions in one or more areas, such as, design, research, development, investigation, construction, management (including project management), education and training. The International Medal is awarded annually to a civil engineer who has made an outstanding contribution to civil engineering outside the United Kingdom or an engineer who resides outside the United Kingdom.

Activity 3: Answer the question to the text

1. What are the objects of the Institution of Civil Engineers in Great Britain?
2. Whose interests does the Institution represent?

3. Who is the Gold Medal of the Institution awarded to?
4. What is the Gold Medal of the Institution awarded for?
5. Can a student of the civil engineering profession be a member of the Institution?
6. Does the organization publish its own magazine?
7. Where is the Institution situated?
8. Who became the President of the organization in 2007?
9. How often is the International Medal awarded?
10. What is it awarded for?

Activity 4

Step 1: Write an abstract to the text and retell it

Step 2: Resume the text in a few sentences starting with

This text is about ……

The main attention is given to ……

It can be interesting for …….

3.1 Grammar focus

Step 1: Revision of the rules

Table 3.1 – future simple / going to

Future Simple / going to		
I, you, he, we, they **will** write **Will** you write? I **will not (won't)** do I, we, you, he, they **shall** write **Shall** we write? He **shall (shan't)** do (tomorrow, next day, soon)	– we decide now; – we make offers, promises, requests; – we make offer or suggestion	The fridge is empty. I **will** go to the supermarket. I **will** carry the bag for you. **Will** you lend me some money? **Shall** I wait for you? **Shall** we go?
I **am going to** write a message. You **are going to** write…… He **is going to** write…… **Am** I going to write a text? **Are** you going to write a text? **Is** he going to write a message? I am **not** going to write a text. They are **not** going to write….. He is **not** going to write ……	– we decide before now; – we can see now what is certain to happen;	I'm going to buy a new car. She hasn't got a coat. She is going to be cold

Table 3.2 – conditional 1

Present simple in time and conditional clauses	
time and conditional words	**example**
if	If he eats too much, he will put up weight.
when	It'll be wonderful when scientists find a cure for cancer.
as soon as	Let me know as soon as your new computer arrives.
before	It'll be several years before we send a mission to Mars.
after	Let's go for a pizza after we visit the history museum.
till / until	The rocket won't be launched until they do a final check

Step 1:

a) Put the verb into the Future Simple Tense or use to be going to

1. It's stuffy. I (to open) …… the window.
2. What are your plans for the summer? When you (to return) ….. home?
3. Let's go to Vienna for a holiday. We (to have) ….. a great time.
4. We are on our way to the Wilsons. We (to have) …… a great time. You (to join) ….. us?
5. I don't know how to use this solar watch. – It's easy. I (to show)….. you how it works.
6. What have you decided to do with the garden? – We (to sell) …… it.
7. Have you heard of the new exhibition? – Not yet. But I (to visit) ….. it as soon as possible.

в) Put the verbs into Future Simple or Present Continuous

1. There (to be) ….. someone at the door. – OK, I ….. (to open) it.
2. They (to drive) ….. Poltava tomorrow morning.
3. Don't touch the fire! You (to hurt) ….. yourself.
4. What are your plans tonight? I (to visit) ….. my mother.
5. Hurry up! We (to miss) ….. the train.
6. They (to get married) ….. in a week.
7. Be careful with that cup. You (to break) ….. it!

c) Put the verbs into Future Simple or Present Simple

1. If it (to rain), …… we (not to leave) ….. home.
2. I (to write) ….. him about this event if you (to tell) ….. me his address.
3. You (to read) ….. English books if you (to study) ….. English.
4. She (to see) ….. her brother when he (to return) ….. from England.
5. If he (to go) ….. to the airport by car he (to catch) ….. a plane.
6. Before she (to go)….. out she (to switch) ….. off the light.

Glossary

Abbreviations: **adj.** = adjective – прикметник; **adv.** = adverb – прислівник; **pl.** = plural – множина; **pp.** = past participle – дієприкметник; **n.** = noun – іменник; **v.** = verb – дієслово

apart from *(adv)*	окрім
aqueduct *(n)*	акведук, водогін
artificial *(adj)*	штучний
association *(n)*	спілка, асоціація, союз
be instrumental in	сприяти (чому-небудь)
body (*n)*	організація, орган
breakwater *(n)*	хвилеріз
charter *(n)*	хартія, грамота
chartered *(adj)*	дипломований
dock *(n)*	док, пристань
drainage *(n)*	каналізація
drum up *(v)*	закликати
establish *(v)*	засновувати
Fellow *(n)*	член наукового товариства
full *(adj)*	повноправний
graduate *(n)*	випускник, аспірант
headway *(n)*	рух уперед, прогрес
inaugural	урочисті
meeting*(n)*	збори
independent *(adj)*	незалежний, самостійний
institution *(n)*	товариство, установа
issue *(n)*	проблема, питання
join *(v)*	стати членом
membership *(n)*	членство, звання учасника
mole *(n)*	дамба, мол
online *(adj)*	оперативний
origin *(n)*	початок, джерело
pinnacle *(n)*	вершина, кульмінація
practitioner *(n)*	що має кваліфікацію
premises *(n, pl)*	приміщення
prominent *(adj)*	відомий, видатний
pursue *(v)*	виконувати, курс
royal *(adj)*	королівський
society *(n)*	спілка, об’єднання
species *(n)*	вид, тип
standing *(n)*	становище, репутація
study *(n)*	наукова робота
subscription *(n)*	передплата (на газету)

UNIT 4

Great British Engineers of the Past: John Smeaton

Activity 1: Match A and B to make the word combinations

A	B
building	lime
scientific	achievement
eminent	material
development of	wood
instrument	engine
to set under	to be dismantled
hydraulic	requirements
expertise in	award
canal	navigation
to built of	water
structure	maker
distinguished	engineer
to devise	physicist
compositional	engineering
maritime	concrete
strong	foundation

Write down the word combinations into the box

Activity 2: Read the text given below:

John Smeaton, (1724–1792), was a civil engineer. He is often regarded as the «father of civil engineering». He was responsible for the design of bridges, canals, harbours and lighthouses. He was also a mechanical engineer and an eminent physicist. He was the first self-proclaimed civil engineer.

He was born in Austhorpe, Leeds, England**.** After studying at Leeds Grammar School, he joined his father's law firm, but then left to become a mathematical instrument maker, developing, among other instruments, a pyrometer to study material expansion and a whirling speculum for maritime navigation.

He was elected a Fellow of the Royal Society (FRS) in 1753. The Royal Society is a learned society for science that was founded in 1660. In 1759 John Smeaton won the Copley Medal for his research into the mechanics of waterwheels and windmills. The Copley Medal is a scientific award for distinguished achievement in any field of science and it is the highest award granted by the Royal Society of London. It is also the society's oldest award created by Sir Godfrey Copley, a wealthy landowner and a member of Royal Society. The paper of John Smeaton addressed the relationship between pressure and velocity for objects moving in air, and his concepts were subsequently developed to devise the «Smeaton Coefficient». Over the period 1759–1782, John Smeaton performed a series of further experiments and measurements on waterwheels.

Recommended by the Royal Society, Smeaton designed the third Eddystone Lighthouse (1755–1759). The Eddystone Lighthouse is situated in the county of Devon, England, on the rocks. It celebrated in folk ballads and seamen's lore, standing on the Eddystone Rocks, 14 miles off Plymouth, England, in the English Channel. The current structure is the fourth lighthouse to be built on the site. The first and second lighthouses were both built of wood accordingly in 1698 and 1705 and destroyed in accidents. The first lighthouse (1696–1699), built of timber, was swept away with its designer, Henry Winstanley, by the great storm of 1703. The second, of oak and iron, designed by John Rudyerd (1708), was destroyed by fire in 1755. John Smeaton built (1756–1759) the third Eddystone Lighthouse entirely of

interlocking stone, on a plan that revolutionized the construction of such towers. The third lighthouse, also known as Smeaton's Tower, is the best known of the four, because of its influence on modern lighthouse design and its importance in the development of concrete as a building material. It was perhaps the most notable as it marked a major step forward in the design of such structures. Recommended to the task by the Royal Society, John Smeaton pioneered the use of «hydraulic lime» (a form of concrete that will be set under water). He identified the compositional requirements needed to obtain «hydraulicity» in lime; work which led ultimately to the invention of Portland cement and developed a technique of securing the granite blocks together using dovetail joints and marble dowels. The lighthouse was built of masonry.

Construction started in 1756 and the light was first lit in 1759. While in use, Smeaton's lighthouse was 59 feet (18 meters) in height, and had a diameter at the base of 26 feet (8 meters) and at the top of 17 feet (5 meters). It remained in use until 1877 when it was discovered that the rocks upon which it stood were becoming eroded – each time a large wave hit the lighthouse it would shake from side to side. Smeaton's lighthouse was largely dismantled and rebuilt in the nearby city of Plymouth, as a memorial. The foundations and stub of the old tower remain on the Eddystone Rocks, situated close to the new (and more solid) foundations of the current lighthouse (see the portrait of John Smeaton, with the Eddystone Lighthouse in the background). The foundations proved too strong to be dismantled. The irony of this lighthouse is that although the previous two were destroyed, this one proved to be stronger than the rock upon which it was built. The fourth one was built in 1882 and its height is 49 meters. In 1982 it was automated and it has white light flashes twice every 10 seconds. The present structure, which rises 133 feet (40 meters) above the water, was designed by Sir James N. Douglass.

Deciding that he wanted to focus on the lucrative field of civil engineering, he commenced an extensive series of commissions, including:

– the Calder and Hebble Navigation (1758–1770);

– Coldstream Bridge over the River Tweed (1762–1767);

– Improvements to the River Lee Navigation (1765–1770);

– Perth bridge over the River Tay (1766–1771);

– Ripon Canal (1766–1773);

– the Newark Viaduct over the River Trent in Nottinghamshire (1768–1770);

– the Forth and Clyde Canal from Grangemouth to Glasgow (1768–1777);

– Banff harbour (1770–1775);

– Aberdeen bridge (1775–1780);

– Peterhead harbour (1775);

– Harbour works at Ramsgate (retention basin 1776–1783; jetty 1788–1792);

– Hexham bridge (1777–1790);

– the Birmingham and Fazeley Canal (1782–1789);

– St Austell‘s Charlestown harbour in Cornwall (1792).

Because of his expertise in engineering, Smeaton was called to testify in a court for a case related to the silting-up of the harbour at Wells-next-the-Sea in Norfolk in 1782. He is considered to be the first expert witness to appear in an English court. Employing his skills as a mechanical engineer, he devised a water engine for the Royal Botanic Gardens at Kew in 1761 and a watermill at Alston, Cumbria in 1767. In 1782 he built the Chimney Mill at Spital Tongues in Newcastle upon Tyne, the first mill of such type in Britain. He also improved Thomas Newcomen‘s atmospheric steam engine, erecting one at Chasewater mine in Cornwall in 1775. Highly regarded by other engineers, he founded the Society of Civil Engineers in 1771. He coined the term *civil engineers* to distinguish them from military engineers graduating from the Royal Military Academy. After his death, the Society was renamed the Smeatonian Society, and was a forerunner of the Institution of Civil Engineers, established in 1818. His pupils included canal engineer William Jessop and architect and engineer Benjamin Latrobe. He died in 1792 and was buried in the parish church at Whitkirk, West Yorkshire. John Smeaton lends his name to a high school in the suburbs of Leeds.

Activity 3: Answer the question to the text

1.Why is Smeaton considered to be a father of civil engineering?

2. What research did Smeaton win the Copley Medal for?

3. What kind of cement did he pioneer?

4. Why is the third Eddystone Lighthouse the best known of the four?

6. How were the first and second lighthouses built?

7. How was the Smeaton's Tower dismantled?

8. When was Smeaton called to testify in a court?

9. Why did he coin the term 'civil engineer'?

10. What organization was the forerunner of the Institution of Civil Engineers?

11. Who were the famous pupils of Smeaton?

12. What school did he lend his name to?

Activity 4

Step 1: Write an abstract to the text and retell it

Step 2: Resume the text in a few sentences starting with

This text is about ……

The main attention is given to ……

It can be interesting for …….

4.1 Grammar focus

Table 4.1 – Prepositions of time / place / direction

Prepositions of time / place / direction		
Key prepositions of time	**at** 3 o'clock (***clockface***) **on** Monday (***day***) **on** September 20th **(*date*)** **in** July (***month***) **in** summer (***season***) **in** the morning / evening **in** 2008 ***(year)*** **at** the moment **at** the weekend **at** night	next / last week **from** Monday **till** Fraday
Key prepositions of place and direction	**place** turn right **at** a place sit **on** the chair wait **in(side)** the building **in / on / at** the corner **of** **next to / by** the building **on** the front / back **of** **behind** the station **opposite** the station **between** the two items	**direction** go **in (to)** the building go t**owards** the building arrive **in** London arrive **at** the station go **out of** the building go **across** the bridge run **through** the tunnel walk **along** the bankment

a) Fill in the gaps with prepositions of time, place or direction where necessary

1. We came …… London ….. the 25th ….. September and left for Oxford ….. October.
2. They went out ….. a quarter ..…. seven (7.15) and arrived just ….. time.
3. We like to play….. football ….. summer and ….. hockey…..winter.
4. He always leaves…… home early…… the morning and comes back late ….. night.
5. I poured some water …… the vase.
6. I was working ….. 7 o'clock …… Friday evening.
7. They went out …… a quarter …….. seven (6.45).
8. I go ….. school ….. bus.
9. There is a nice carpet ……. the floor.
10. Our vacation began ….. 27th……. May.

в) Fill in the gaps with prepositions for, till, from, during, in

1. He received a letter ……. Home.
2. He lived there ……. April till June.
3. The First World War began ….. 1915 and lasted ……1918.
4. Can you put some sugar …… my tea?
5. What do you do ……. the lesson?
6. You will have to wait ……. Sunday.
7. The last two questions are different ……… the first one.
8. I keep my files and papers …… a large drawer.
9. The plane is ready ……. the flight.
10. A strong wind came ……. the sea.
11. He was very happy ……. the time he spent in Japan.
12. He didn't say anything …….. a long time.

c) Each of the words in bold is incorrect. Rewrite them correctly

1. My Australian cousins are coming **in** ….. Greece next month!
2. Turn left **on** …… the post office, then go straight on.
3. There weren't any chairs, so we had to sit **at** …… the floor.
4. The TV's **on** …… the corner of the room.
5. There's a photo of the author **at** ….. the back cover of the book.
6. We should arrive **to** …… Paris at six in the morning.
7. Could you go out **from** …… the room for a moment, please?
8. Walk **to** …… the station, but turn left a couple of blocks before you get there.
9. I'll meet you **in** …… the corner of your street.
10. There should be a broom **on** …… the back of the cupboard, somewhere.
11. They should arrive **in** …… the airport in about an hour.
12. The airports must be next **from** …… the mobile.

Glossary

Abbreviations: **adj.** = adjective – прикметник; **adv.** = adverb – прислівник; **pl.** = plural – множина; **pp.** = past participle – дієприкметник; **n.** = noun – іменник; **v.** = verb – дієслово

award *(n, v)*	нагорода, нагороджувати
coin the term	вигадати термін
commission *(n)*	замовлення
concrete *(n)*	бетон
devise *(v)*	винаходити
dismantle *(v)*	демонтувати
dovetailed *(adj)*	зв’язаний шипами як хвіст ластівки
dowel *(n)*	шип, болт
eminent/ preeminent *(adj)*	славнозвісний
erode *(v)*	роз’їдати, розмивати
establish *(v)*	засновувати
Fellow *(n)*	член товариства
flash *(n)*	спалах
grammar school	класична середня школа
harbour *(n)*	гавань, порт
high school *(n)*	середня школа
hydraulic lime	гідравлічне вапно
instrument *(n)*	прилад
jetty *(n)*	мол
lighthouse *(n)*	маяк
lucrative *(adj)*	прибутковий, вигідний
marble *(n)*	мармур
masonry *(n)*	кам’яна / цегляна кладка
mill *(n)*	млин
mine *(n)*	рудник, шахта
paper *(n)*	наукова стаття / доповідь
parish church	парафіяльна церква
physicist *(n)*	фізик
prominent *(adj)*	відомий, видатний
retention basin	регулюючий басейн
rock *(n)*	скеля
royal society	королівська спілка
silting-up *(n)*	замулення
structure *(n)*	споруда, конструкція
waterwheel *(n)*	водяне колесо
whirling	аеродинамічний
speculum *(n)*	рефлектор

UNIT 5

Great Structures of the Past: The Channel Tunnel

Activity 1

a) Translate the following word combinations into Ukrainian

– boring machine;
– freight train;
– significant loss;
– to launch project;
– horse-drawn coaches;
– chalk stratum;
– rubber-tyred vehicles;
– conducted simultaneously;
– to turn around;
– a cost overrun;
– undersea section;
– to provide a respite;
– concreted in place;
– floating steel tube.

в) Put the word combinations into the right group from the table

material	device	action / result

Activity 2: Read the text given below

The Channel Tunnel, or Chunnel, is a long rail tunnel beneath the English Channel at the Strait of Dover, connecting England to France. It is 50,450 km (31,35 miles) long, of which 37,9 km (23,55 miles) are undersea. The average depth is 45,7 m (150 feet) underneath the seabed, and the deepest is 60 m (197 feet). It was a megaproject with several false starts, but it was finally completed in 1994. It is the second-longest rail tunnel in the world, with the Seikan Tunnel in Japan being longer, but the undersea section of the Channel Tunnel, at 37,9 km (23,55 miles), is the longest undersea tunnel in the world. It is operated by the company Eurotunnel that built and funded the project. In 2005 8,2 million passengers travelled through the tunnel. The American Society of Civil Engineers has declared the tunnel to be one of the Seven Wonders of the Modern World.

A link between Great Britain and mainland Europe had been proposed on many occasions. In 1802 Albert Mathieu-Favier, a French engineer, put forward a proposal for a tunnel. Passengers would travel through the tunnel in horse-drawn coaches, the road would be lit by oil lamps and a mid-tunnel island would have provided a fresh-air respite for the horses. The cost was estimated at one million pounds. In 1875 Peter William Barlow, who had worked extensively on the world's first underground railway, suggested a floating steel tube across the Channel. The idea was rejected. In 1876 extensive geological survey was carried out; French sank two shafts. In 1880 the South Eastern Railway (SER) arranged trial borings on the British side. In 1881 boring machine drove a tunnel about 820 m long (897 yards) parallel to cliffs on the British side. Work was begun by SER on Channel Tunnel but funds were insufficient. In 1922 workers started boring a tunnel from below the chalk cliffs between Folkestone and Dover: after 128 m (400 feet) of tunnel had been completed, political objections brought the project to an end.

After World War II the concept of the tunnel began to receive serious attention. In 1957 the Tunnel Study Group was formed. It reported in 1960 and recommended two main railway tunnels and a smaller service tunnel. The project was launched in 1973 but folded due to financial problems in 1975 after the construction

of a 250 m (820 feet) test tunnel. In 1984 the idea was relaunched with a joint British and French government request for proposals to build a privately-funded link. There were several proposals: two rail tunnels, a road tunnel and a bridge. Of the four submissions received, the one plan was chosen. The Franco-British Channel Fixed Link Treaty was signed by the two governments in 1986 and ratified in 1987. The planned route of the tunnel took it from Calais to Folkestone (a route rather longer than the shortest possible crossing) and the tunnel follows a single chalk stratum, which meant that the tunnel was deeper than the previous attempt. For much of its route the tunnel is nearly 40 m (130 ft) under the sea floor, with the southern section being deeper than the northern.

Digging the tunnel took 13,000 workers over seven years, with tunneling operations conducted simultaneously from both ends. The prime contractor for the construction was the Anglo-French Trans Manche Link (TML), a consortium of ten construction companies and five banks of the two countries. Engineers used large tunnel boring machines (TBMs). In all, eleven TBMs were used on the Channel tunnel. On December 1, 1990 the service tunnels broke through at the halfway point. The main rail tunnels met on May 22, 1991 and on June 28, 1991, each accompanied by a breakthrough ceremony. When each pair of TBMs met, the French TBM was dismantled while the British one was diverted into the rock, concreted in place, and abandoned. The next few years were spent refining, equipping, and finishing the tunnels. In 1994 the Channel Tunnel was considered completed. In the end, almost 4 million m^3 (5 million cubic yards) of chalk were excavated on the British side, much of which was dumped below Shakespeare Cliff near Folkestone to reclaim 0,36 km^2 (90 acres) of land from the sea. Called Samphire Hoe, the area is now a popular park.

The tunnel consists of three parallel tunnels running between the respective portals, or tunnel entrances, at either end. There are two rail tunnels, measuring 7,6 m (25 ft) in diameter and about 30 m (98 ft) apart, which carry trains north-west and south-east. Between the rail tunnels is a service tunnel, 4,8 m (16 ft) in diameter, which is connected by cross-passages to the main tunnels at intervals of

approximately 375 m (1,230 ft). The service tunnel, served by narrow rubber-tyred vehicles, gives maintenance workers access to the rail tunnels and provides a route for escape during emergencies. The two running tunnels are directly linked every 250 m (820 ft) by 2 m diameter pressure relief ducts (PRDs) that pass over the top of the service tunnel and are not connected to it. The PRDs alleviate the piston effect of trains by allowing airflow from moving trains to pass into the other running tunnel. Additionally, there are two enormous caverns situated about one third of the distance from shore to shore containing a rail crossover between the main tunnels. These crossovers permit sections of the tunnel to be closed to traffic for maintenance, using single-line working in the other tunnel. The UK crossover at 156 m long, 18 m wide and 10 m high is the largest subsea cavern in the world. At each portal there is a major facility allowing for trains to disassemble and turn around, including customs, maintenance, and other necessary services.

The tunnel was officially opened by Queen Elizabeth II and French President François Mitterrand in a ceremony held in Calais on 6 May 1994. Four types of train services operate: high speed passenger trains (carry passengers), passenger shuttle trains (passengers stay with their vehicles), freight shuttle trains (carry lorries on open rail wagons, with the lorry drivers traveling in a separate passenger coach) and freight trains (carry container loads). A journey through the tunnel lasts about 20 minutes; from start to end, a shuttle train journey totals about 35 minutes. The maximum speed is 300 km / h or 186 mph, and within the tunnel is approximately 160 km/h or 100 mph to avoid problems with heat generated in the tunnels by friction.

At completion, it was estimated that the whole project cost around £10 billion, including a cost overrun of 80 percent. The tunnel has been operating at a significant loss, and shares of the stock that funded the project lost 90 % of their value between 1989 and 1998. The company announced a loss of £1.33 billion in 2003 and £570 million in 2004, and has been in constant negotiations with its creditors. In its defense, Eurotunnel cites a lack of use of the infrastructure, an inability to attract business because of high access charges, too much debt which causes a heavy interest payment burden, and a low volume of both passenger and

freight traffic 38 % and 24 %, respectively, of that which was forecast. Eurotunnel has investigated the possibility of a second tunnel through the Channel, but the economic case has not been made. The planning has not progressed past the feasibility stage.

Activity 3: Answer the question to the text

1. Which country does the Channel Tunnel connect England to?
2. Is it the longest tunnel in the world?
3. How deep is it?
4. Is it a rail tunnel or a road tunnel?
5. How much time does it take to travel through the Tunnel?
6. When was the Tunnel officially opened?
7. What are the dimensions of the Tunnel?

Activity 4

Step 1: Write an abstract to the text and retell it

Step 2: Resume the text in a few sentences starting with

This text is about ……

The main attention is given to ……

It can be interesting for …….

5.1 Grammar focus: A / Zero Articles

Step 1: Revision of the rules

Table 5.1 – Indefinite article a / an

indefinite article a / an	
– used with singular countable nouns when we talk about things in general	An airplane is faster than a train
– after the verbs **to be** and **have / have got**	He is a photographer. He has got a camera
– **do not use** with uncountable or plural nouns. We can use **some** instead	Would you like some tea? Yes, please! And I'd like some biscuits
zero article	
– proper nouns. titles with proper names	Paula comes from Canada President Bush
– names of continents, countries, cities, streets, parks	Europe, Italy, London, Hyde Park, Bond Street
– names of substances, meals, sport activities	Soda isn't expensive. Lunch is ready. He plays tennis well
– *school, hospital, prison, church* when they are used for the reason they exist	John was taken to hospital. **But:** His mother went to <u>the</u> hospital to see him
– means of transport and traveling	by car, by plane, by sea

a) Put indefinite article into the gaps or omit the article where necessary

1. She is……good model maker: she makes models of the objects beautifully.
2. It's ….. shame! There won't be another opportunity to see the site.
3. I had ….. meeting with my colleagues on ….. Monday.
4. He makes ..…investigation, …… calculation and ….. management.
5. I think she is gone …… home.
6. In 1994 …… Chunnel was considered completed.
7. Specialists proposed …… second tunnel through the Channel.
8. The Committee studied …..... different submissions.
9. ……proposals for a tunnel were made in the 19th century.
10. Employing his skills as …… mechanical engineer, he fulfilled many projects.
11. Smeaton devised …… water engine for the Royal Botanic Gardens at …. Kew in 1761 and ……. watermill at Alston, ……. Cumbria in 1767.

12. The Gold Medal is awarded to …… individual who has made ……valuable contributions to ……. civil engineering over many years.

в) Fill in with a, an or some

1. …… investigation;
2. …… proposal;
3. …… ideas;
4. ….. chalk;
5. ….. stratum;
6. ….. crossovers;
7. ….. burden;
8. ….. opportunity;
9. ….. ceremony;
10. …… data.

c) Put indefinite article into the gaps or omit the article where necessary

1. Engineering is ….. profession, which means that you must have …… specialized university education.
2. ……. great deal of calculation is involved in solving these problems.
3. Smeaton improved Thomas Newcomen's atmospheric steam engine, erecting one at …… Chasewater mine in Cornwall in 1775.
4. The Copley Medal is …… scientific award for distinguished achievement in any field of ……. science.
5. After studying at …… Leeds Grammar School, Smeaton joined his father's law firm.
6. The Royal Charter is ….. signed document from …… king or ….. queen which allows …… town, organization, or university to officially exist and have special rights.

Glossary

Abbreviations: **adj.** = adjective – прикметник; **adv.** = adverb – прислівник; **pl.** = plural – множина; **pp.** = past participle – дієприкметник; **n.** = noun – іменник; **v.** = verb – дієслово

alleviate *(v)*	полегшувати
apart *(adv)*	на відстані
beneath *(prep)*	під, нижче
boring *(n)*	буріння, свердління
breakthrough	церемонія
ceremony *(n)*	відкриття
cavern *(n)*	печера
chalk *(n)*	крейда
cliff *(n)*	скеля, круча
coach *(n)*	карета, екіпаж
crossing *(n)*	переправа
crossover /	поперечний
cross passage (*n)*	перехід
dismantle *(v)*	розбирати, демонтувати
divert *(v)*	відводити вбік
drilling *(n)*	буріння
duct *(n)*	канал, трубопровід, тунель
dump *(v)*	скидати, звалювати,
English Channel *(n)*	протока Ла-Манш
floating (*adj*)	понтонний
freight [freit] *(n)*	вантаж, фрахт
horse-drawn *(adj)*	на кінній тязі
launch *(v)*	розпочинати
piston *(n)*	поршень
portal *(n)*	головний вхід, портал
pressure relief	резервний напірний
duct (PRD)	тунель
rail *(n)*	рельс
respite *(n)*	перепочинок
rock *(n)*	гірська порода, скеля
seabed *(n)*	морське дно
shaft *(n)*	шахтний колодязь
shuttle *(n)*	човник
simultaneously *(adv)*	одночасно
single-line (*adj*)	одноколійний
sink *(v)* (sank, sunk)	занурювати
Strait of Dover *(n)*	Па-де-Кале
stratum *(n)*	шар, верства
trial *(n)*	проба, випробування

UNIT 6

Great Structures of the Past: The Sydney Opera House

Activity 1: Match A and B to make the word combinations

A	B
precast	level
electrical	requirements
periodic	difficulties
musical	concrete «shells»
self-cleaning	the roofs
sea	productions
shell	opinion
height	cable
mass	the roof structure
seating	date
unexpected	solution
forming	maintenance
public	meetings
to support	nature
acceptable	areas
completion	groupings

Write down the word combinations into the box

Activity 2: Read the text given below

The Sydney Opera House is located in Sydney, New South Wales, Australia. It is a UNESCO World Heritage Site, as appointed on 28 June 2007. Designed by Jorn Utzon, a Danish architect, the Sydney Opera House is one of the most distinctive and famous 20th century buildings, and one of the most famous performing arts venues in the world. As well as many touring theatre, ballet, and musical productions, the Opera House is the home of Opera Australia, the Sydney Theatre Company and the Sydney Symphony. It is administered by the Opera House Trust, under the New South Wales Ministry of the Arts.

Description. The Sydney Opera House is an expressionist modern design, with a series of large precast concrete 'shells', each taken from a hemisphere of the same radius, forming the roofs of the structure. The Opera House covers 1,8 hectares (4,5 acres) of land. It is 183 meters (605 feet) long and about 120 meters (388 feet) wide at its widest point. It is supported on 580 concrete piers sunk up to 25 meters below sea level. Its power supply is equivalent for a town of 25,000 people. The power is distributed by 645 kilometers of electrical cable.

The roofs of the House are covered with 1,056 million glossy white and matte cream Swedish-made tiles, though from a distance the tiles look only white. Despite their self-cleaning nature, they are still subject to periodic maintenance and replacement. The Concert Hall and Opera Theatre are each contained in the two largest groups of shells, and the other theatres are located on the sides of the shell groupings. The form of the shells is chosen to reflect the internal height requirements, rising from the low entrance spaces, over the seating areas and up to the high stage towers. A much smaller group of shells is set to one side of the Monumental steps and houses the Bennelong Restaurant. Although the roof structures of the Sydney Opera House are commonly referred to as shells (as they are in this article), they are in fact not shells in a strictly structural sense, but are instead precast concrete panels supported by precast concrete ribs. The building's interior is composed of pink granite quarried in Tarana and wood and brush box plywood supplied from northern New South Wales.

Performance venues and facilities. The Sydney Opera House contains five theatres, five rehearsal studios, two main halls, four restaurants, six bars and numerous souvenir shops. Besides theatrical productions, venues at the Sydney Opera House are also used for functions such as weddings, parties and conferences.

Construction history. Planning for the Sydney Opera House began in the late 1940s. The competition was launched on 13 September 1955 and received a total of 233 entries from 32 countries. The criteria specified a large hall seating 3 000 and a small hall for 1 200 people, each to be designed for different uses including full-scale operas, orchestral and choral concerts, mass meetings, lectures, ballet performances and other presentations. The basic design announced in 1957 was the one submitted by Jorn Utzon, a Danish architect. Utzon arrived in Sydney in 1957 to help supervise the project.

Design and construction. The formal construction of the Opera House began in March, 1959. The project was built in three stages. Stage I (1959–1963) consisted of building the upper podium. Stage II (1963–1967) saw the construction of the outer shells. Stage III consisted of the interior design and construction (1967–1973).

Stage I: Podium. It was commenced on December 5, 1958, by the construction firm Civil & Civic. The government had pushed for work to begin early fearing that funding, or public opinion, might turn against them. However major structural issues still plagued the design (most notably the sails, which were still parabolic at the time). By January 23, 1961, work was running 47 weeks behind, mainly because of unexpected difficulties (inclement weather, unexpected difficulty diverting stormwater, construction beginning before proper construction drawings had been prepared, changes of original contract documents). Work on the podium was finally completed on August 31, 1962. The forced early start led to significant later problems, not least of which was the fact that the podium columns were not strong enough to support the roof structure, and had to be re-built.

Stage II: Roof. The shells of the competition entry were originally of undefined geometry, but early in the design process the «shells» were perceived as a series of parabolas supported by precast concrete ribs. However, engineers Ove Arup

and partners were unable to find an acceptable solution to construct them. They had to find a way in which to economically construct the shells from precast concrete, because the formwork for using in-situ concrete would have been prohibitively expensive. Without repetition in the roof forms the construction of precast concrete would also be too expensive.

From 1957 to 1963 the design team went through at least twelve iterations of the form of the shells (including schemes with parabolas, circular ribs and ellipsoids) before a workable solution was completed. The design work on the shells involved one of the earliest uses of computers in structural analysis in order to understand the complex forces the shells would be subject to. In mid –1961 the design team found a solution to the problem: the shells all being created as sections from a sphere.

The shells were constructed by Hornibrook Group Pty Ltd, who were also responsible for construction in Stage III. Hornibrook manufactured the 2 400 precast ribs and 4 000 roof panels in an on-site factory, and also developed the construction processes. The achievement of this solution avoided the need for expensive formwork construction by allowing the use of precast units (it also allowed the roof tiles to be prefabricated in sheets on the ground, instead of being stuck on individually at height).

Stage III, the interiors, started with Utzon moving his entire office to Sydney in February 1963. However, there was a change of government in 1965, and the new Robert Askin government declared the project under the jurisdiction of the Ministry of Public Works. This ultimately led to Utzon's resignation. The cost of the project so far, even in October of that year, was still only 22,9 million, less than a quarter of the final cost. However, the projected costs for the design were at this stage much more significant. The second stage of construction was still in process when Utzon resigned. His position was principally taken over by Peter Hall, who became largely responsible for the interior design. The Opera House was formally completed in 1973, having cost $ 102 million. The original cost estimate in 1957 was £ 3,500,000 ($ 7 million). The original completion date set by the government was

January 26, 1963. But it took 14 years to complete, and the Opera House was finally opened by Queen Elizabeth II on October 20, 1973.

Activity 3: Answer the question to the text

1. Do you know anything about the Sydney Opera House?
2. What is unusual in its design?
3. How many countries took part in the competition?
4. Who was the architect of the Sydney Opera House?
5. What led to his resignation?
6. What did the design work on the shells involve?
7. What does the Sydney Opera House consist of?
8. How many stages were there in construction of the Sydney Opera House?
9. What was the cost estimate of the Sydney Opera House?

Activity 4

Step 1: Write an abstract to the text and retell it

Step 2: Resume the text in a few sentences starting with

This text is about ……

The main attention is given to ……

It can be interesting for …….

6.1 Grammar focus

Step 1: Revision of the rules:

Table 6.1. – definite article

the is used before	
– singular or plural nouns, both countable and uncountable, when we talk about something specific or when the noun is mentioned for a second time	The boy who has just left is my cousin. There is a cat on the sofa. The cat is sleeping
– nouns which are unique	Haven't you been to the Acropolis yet?
– names of the oceans, seas, rivers, groups of mountains / islands, deserts	The Pacific Ocean, the Black Sea, the Thames, the Alps, the Bahamas, the Goby Desert
– musical instruments	Can you play the guitar?
– the superlative degree of the adjectives / adverbs	He's the most intelligent students of all
– ordinal numerals	the first, the tenth
– parts of the day	in the morning. in the evening **but:** at night
– names of families, nationality words	the Smiths, the Italians
– with the words *cinema, theatre, radio, country(side), sea side, beach, world, weekend.*	We go to the beach every Sunday
– names of cinemas, hotels, theatres, museums, newspapers, ships	The Hilton, the Prado, the Times

a) Put the articles where necessary

1. …. Alaska has ….. coldest winters in …… world.
2. You must decide which things are …... most important.
3. ….. Nile is ……. longest river in …... world.
4. ….. land in this part of ….. country is fertile. …… land in ….west is ….. less fertile.

5. Charles Dickens was born in ….England.
6. Christchurch is ..…. small town in …… south of ……England.
7. …….. Dnipro is ….. long river.
8. Poland is to ……west of …..Ukraine.

в) Put the articles where necessary

1. He was covered from ….. head to….. foot with …… dust.
2. …. more I looked at it, ….. stranger it seemed.
3. ….. nature is more wonderful than……works of …… man.
4. ….. dictionary is….. great help to……students with ….. bad memory.
5. He is ….. man for …… job! None other can do it so well.
6. What is ….. matter? Have you had …. accident?
7. He asked for ….. bread and …. butter.
8. ……Visuvius is ….. active volcano near …. Bay of ….. Naples.

c) Put the articles a, an, the where necessary

1. ….. last two years of …… engineering program include subjects within ….. student's field of specialization.
2. …… second large category of jobs related to housing construction involves ….. building tradespeople.
3. Civil engineers who have successfully completed ……. special examinations become …… chartered engineers.
4. Over …… period 1759-1782, John Smeaton performed …… series of further experiments and measurements on ……. waterwheels.
5. ….. Channel tunnel has been operating at …… significant loss.
6. ….. Sydney Opera House is one of ….. most distinctive and famous 20th century buildings.

7. ……. careful study is given to each project even before …… design work begins.

Glossary

Abbreviations: **adj.** = adjective – прикметник; **adv.** = adverb – прислівник; **pl.** = plural – множина; **pp.** = past participle – дієприкметник; **n.** = noun – іменник; **v.** = verb – дієслово

art venue *(n)*	місце дії
competition*(n)*	змагання
diverting	видхилення
stormwater	прорив води / зливова каналізація
entry *(n)*	заявка на участь
formwork *(n)*	опалубка
full-scale *(adj)*	великомасштабний
glossy *(adj)*	блискучий
inclement *(adj)*	суворий
in-situ concrete	покладена бетонна суміш
interious *(adj)*	внутрішній
interration *(n)*	повторення
issue *(n)*	спірне питання
launch *(v)*	починати
matte *(adj)*	матовий
parabolic *(adv)*	параболічний
perceive *(v)*	усвідомлювати
pier *(n)*	стовп
plague *(v)*	докучати, турбувати
precast	збірний
concrete	залізобетон
punch *(v)*	штампувати
refer *(v)*	звернутися
resignation *(n)*	відставка
rib *(n)*	ребро
run behind	відставати
self-	що
cleaning *(adj)*	самоочищується
shell *(n)*	раковина
submit *(v)*	подавати на розгляд
supervise *(v)*	спостерігати
tile *(n)*	плитка
ultimately*(adv)*	врешті-решт / зрештою

UNIT 7

Computer Application in Design

Activity 1: Match A and B to make the word combinations

A	B
a significant	intensive
three	to-use
a software	treatment
labor	program
to meet	efficient
water	appliances
careful	forces
standard	estimates
outside	planning
ultimate	time
to save	result
easy-	dimensions
aging	impact
energy-	reality
virtual	a need
cost	feature

Write down the word combinations into the box

Activity 2: Read the text given below

It is an accepted fact that computers and specialized software have had a significant impact on planning, designing, constructing, and furnishing modern housing units. Computers are now used for various tasks, such as: drafting, designing, and rendering plans; adding color and shading to layouts; displaying plans in three dimensions; touring building interiors from a walk-through perspective; analyzing a housing unit's energy use; and generating all the necessary reports. Today practically every architect, builder, and interior designer can have access to powerful drafting, that are designed to make their work easier and more efficient. The four basic categories of computer applications in the housing field are: design and analysis, selection of construction elements and processes, service to clients and customers, and project management.

Design and analysis. This category includes four primary areas: computer-assisted drafting and design; plot, site, and landscape planning; kitchen and bath design; and energy analysis. The number and type of software programs for these topics are rapidly increasing. The largest and most familiar area of computer application in housing is computer-assisted drafting and design. CADD is a computer program that can automatically draw objects to scale or exact measurements. By being able to retrieve standard components or drawings from the computer's memory, the designer is able to save time and improve accuracy. Previously, traditional drawings were done by hand, which is very labor intensive and costly for large-scale projects.

Another benefit of CADD is its computerized symbols library. Inserting standard symbols and shapes is quick, easy, and accurate. For example, symbols for trees, furniture, doors, windows, etc. are usually included in an architectural symbols library. When inserting an image in a document, it can be enlarged, reduced, or rotated to a different angle to meet a specific need.

Plot, Site and Landscape Planning are required for most homes and apartment buildings. The plot plan shows the site and location of the buildings on the property. A site plan includes a complete description of the shape, size, and important features

on the site. The landscape plan shows all the plants on the site as well as paved areas, fences, and other landscape elements. Some landscape programs even have an aging feature to show how the landscape will change over time as plants mature. Other computer applications used in plot, site, and landscape planning include design and evaluation of water treatment systems, water surface profile analysis, calculation of the volume quantities of earth that must be removed from the site or brought in for fill.

Kitchens and bathrooms are two of the most expensive areas per square foot in the home. Both require careful planning to achieve maximum efficiency. As a result, numerous software programs have been developed to assist in designing these rooms and selecting standard appliances, cabinets, and fixtures.

Since energy costs today are so significant, a complete energy analysis should be performed for most planned structures. Using these programs, the designer is able to analyse all aspects of energy efficiency and plan energy-efficient structures.

Selection of construction elements and processes. The design process frequently involves one or more areas not generally included in typical CADD software. These include: structural component analysis and selection and preferred techniques for construction. Structural analysis allows the designer to design building components able to withstand the building's own stress and weight plus the impact of outside forces. Most nontraditional building designs require structural analysis to ensure design integrity. An architect uses descriptive analysis to calculate stress forces in unique residential structures and structural elements. Other common computer applications focus on the strength and elastic stability of building materials, heat transfer, pipe rupture and fluid-flow analysis.

Great assurance is required that the structural components have enough strength to support the intended loads. Many of these structural components are available in new engineered-wood products, which are unfamiliar to many designers and builders. As a result, both do-it-yourselfers and professionals are turning to application-specific software programs to help them select components of the proper size and type for a particular application. One of the most useful functions of the

computer is its ability to simulate, or illustrate, results before the structure or system is built. For example, by changing the layout and/or mixing cabinets of different dimensions, the kitchen can be tailored to satisfy the client's needs. A wide variety of computer simulation applications are available to show the ultimate results of changing various materials, designs, and systems affecting the home's interior and exterior.

Service to clients and customers. The basic categories of software programs designed for clients and potential customers include: home planning aids, interior design packages, Internet sources, and virtual reality models. Since visualizing the completed structure from a set of constructional drawings is difficult for most people, hand-drawn pictorials and three-dimensional models were commonly used. However, these methods frequently failed to provide enough detailed information for decision making. Now designers can show clients photo-quality representations that display every detail of a building plan. Besides, numerous easy-to-use software programs help customers select home furnishings, arrange them in a living space, and see the arrangement in a realistic fashion. The most impressive part of virtual reality models is that a person can «walk» through a house and «see» its finished appearance before any construction begins. The client can enter any room and even look out a window. Another advantage of the virtual model is that the computer can modify elements in the interior, such as removing a wall or changing carpet colors, with the click of the mouse.

Project Management. The computer may be used to assist in cost estimates, financial models, and scheduling for the construction. Most builders agree that «as the building schedule goes, so goes the whole operation». When scheduling is bad, everything else suffers, especially quality, efficiency, employee relations, and customer satisfaction. Estimating is one of the most important aspects of a building contractor's business. An accurate and up-to-date database of unit prices is a must. Most estimators use standard databases which are regularly updated for each section of the country. Keeping track of financing, cash flow, and payment schedules can directly affect the project schedule as well as the profit margin.

Activity 2: Answer the question to the text

1. What are computers used for in planning and constructing modern housing units?
2. What are four basic categories of computer applications in the housing field?
3. What are the benefits of computer application in housing?
4. What is computer simulation?
5. What is the most impressive part of virtual reality models?
6. What is the computerized symbols library used for?
7. What does computer applications of structural analysis focus on?
8. What are the advantages of virtual reality models?
9. Why is building schedule so important?

Activity 3: Write an abstract to the text and retell it

Activity 4: *Resume the text in a few sentences starting with*

This text is about ……

The main attention is given to ……

It can be interesting for ……

7.1 Grammar focus

Step 1: Revision of the rules

Table 7.1 –Modals and semi-modals

Modals and semi-modals		
Current or general ability	can	He **can** swim 10 miles
Decisions made now about future ability	can	We **can** meet there tomorrow
Past ability	could	I **could** run a kilometre in four minutes when I was younger
Current or general hypothetical ability	could	If only I **could** go with you!
Ability for infinitives and other tenses	to be able to	I'd love **to be able to** invite you. He will **be able to** finish this work soon
Asking for or giving permission	may could can	**Can/could/may** I seat here?
Asking for or giving advice	should ought to	You **should** see a doctor
Criticizing past behaviour	should ought to (perfect infinitive)	I **should/ought to have tried** harder

Step 2:

a) Some phrases in bold are incorrect. Rewrite them correctly

1. Can you **to design** a plan for me?

_____

2. He'll **can** retrieve drawings from the computer's memory

_____

3. To save time we **can** use symbols library before we finished this project!

_____

4. If only I **can** afford smart home technology!

_____

5. They could **get** more expensive building materials and landscape elements, but they didn't seem worth it.

_____

6. **Am I able to** show you a virtual model of my house?

_____

7. You should **keeping** track of payment schedules as it **ought to** affect the project in general

_____

в) Write a modal or semi-modal in each gap to complete the sentences

1. You …..……. get planning permission before you start building.

2. Today practically every interior designer …..……. have access to powerful drafting, that make their work easier and more efficient.

3. We …..……. discuss how to meet a client's need at the meeting tomorrow.

4. I wish I …..……. apply aging feature to my project.

5. Interior designers …..……. arrange purchases of furniture, floor and wall coverings.

6. You …..……. have used so labor intensive technologies in your project.

7. Using these programs, the designer…..……. to plan energy-efficient structures.

8. A site plan …..……. include a complete description of the shape, size, and important features on the site.

9. An architect will …..……. to use descriptive analysis to calculate stress forces in structural elements.

10. A complete energy analysis …..……. be performed for most planned structures.

c) Choose the correct answer

1. You really ……. meet all the client's needs if they are unreasonable. A. can't; B. mightn't; C. shouldn't. 2. I hope we ……. find a site easily. A. could; B. can; C. may.	3. We'd love to ……. use these new eco-friendly materials in all our buildings. A. can B. be able to C. could 4. You should ……. track of financing! A. have kept B. kept C. had kept

Glossary

Abbreviations: **adj.** = adjective – прикметник; **adv.** = adverb – прислівник; **pl.** = plural – множина; **pp.** = past participle – дієприкметник; **n.** = noun – іменник; **v.** = verb – дієслово

access *(n)*	доступ
accurate *(adj)*	точний
aging *(n)*	старіння
appearance *(n)*	зовнішній вигляд
appliance *(n)*	прилад, пристрій
arrange *(v)*	організувати
descriptive *(adj)*	той, що описує
draft *(n)*	креслення
estimate *(n)*	оцінка
feature *(n)*	функція
fixture *(n)*	пристосування
frequently *(adv)*	часто
insert *(v)*	вставити
integrity *(n)*	цілісність
landscape *(n)*	ландшафт
layout *(n)*	макет
margin *(n)*	маржа, межа
mature *(adj)*	зрілий
measurement *(n)*	вимірювання
plot *(n)*	ділянка
preferred *(adj)*	бажаний
primary *(adj)*	первинний
property *(n)*	власність
quality *(n)*	якість
rapidly *(adv)*	швидко
render *(v)*	візуалізувати
rupture *(n)*	розрив, прорив
scale *(n)*	масштаб
scheduling	планування
site *(n)*	місце для забудови
software *(n)*	програмне забезпечення
suffer *(v)*	страждати
ultimate *(adj)*	остаточний

UNIT 8

Building a Skyscraper

Activity 1: Complete the following sentences with the definitions given

superstructure, public amazement, sewerage, girders, wires, to support the load, to fill with, solid rock, to dig a trench, prefabricate, pile foundation, to transmit load.

1. ……. is to bear the weight of a structure or object.
2. ……. is a monolith that is composed of a single mineral or material.
3. ……. means to create a long, narrow hole in the ground.
4. ……. is the upper part of a structure, such as a building or bridge, that is built on top of a foundation or substructure.
5. ……. means constructed in advance, usually in standard sections that can be easily transported and assembled.
6. …….. is the system of pipes and drains used to carry wastewater away from buildings.
7. …….. means to transfer the weight of a structure or object from one point to another.
8. ……. a feeling of surprise or admiration expressed by a large group of people.
9. ……. is a type of foundation that uses long, cylindrical columns to support a structure.
10. ……. means to pack something with a substance or material.
11. ……. are thin strands of metal, usually copper or aluminium, used to conduct electricity.
12. ……. are large, steel beams used to support the weight of a structure.

Activity 2: Read the text given below

Skyscraper is the name given to the world's tallest buildings. The word *skyscraper* originally referred to a tall mast or its main sail on a sailing ship. The term was first applied to buildings in the late 19th century as a result of public amazement at the tall buildings being built in Chicago and New York City. In these cities, business people wanted concentrated centres that would provide quick access to offices, warehouses, and banks. Rising land costs also increased the desire to build upwards. The first skyscraper was the ten-story The Home Insurance Building in Chicago, built in 1884–1885. While its weight is not considered unusual or very impressive today, the architect, William Le Baron Jenney, created the first load-bearing metal frame. This development led to the «Chicago skeleton» form of construction. Today skyscrapers are an increasingly common sight where land is scarce, as in the centres of big cities, because of the high ratio of rentable space per area of land. They are considered symbols of a city's economic power.

Skyscrapers have two main parts, the foundation (the part below ground) and the superstructure (the part above ground). Both parts help support the load (weight or force) of the building. In skyscrapers over 40 stories tall, the wind load – that is, the force of the wind blowing against the sides of the building – becomes more important than the weight. The superstructure transmits the load to the foundation. The foundation consists of steel or concrete columns called piles that rest on a layer of solid rock or soil. The foundation transmits the load to this supporting layer.

In most buildings less than four stories high, the walls transmit the load to the foundation, but skyscrapers require a different type of construction. In skyscrapers, a steel or concrete frame supports the building much as a skeleton supports a body. The walls transmit no load but merely hang on the frame like curtains. The beams, girders, and columns that make up this skeleton carry the loads of the roof, walls, and floors.

Before construction begins, engineers determine the kinds of soils underneath the new building. With this information, they can design the proper foundation. After the building site is cleared, levelled, and drained of water, excavation begins. Most

skyscrapers are supported by rock foundations. Ground made of rock may be excavated by blasting. Sometimes workers dig a trench on all sides of the foundation and fill it with concrete before excavation begins. Pumps can be used to keep water from the excavation area at all times.

After the excavation is finished, the footings and the superstructure are built. Most steel used in the superstructure, such as beams, girders, and columns, comes prefabricated. Each piece of steel has a number indicating the exact place where it should be used. When the steel is raised into place, workers fasten the pieces together temporarily with bolts. Later welders or bolt-up crews join these pieces permanently.

Many kinds of derricks and cranes are used in the construction of skyscrapers. The two main kinds are mobile cranes and tower cranes. Mobile cranes are mounted on trucks or special vehicles and can maneuver around the outside of the building to hoist materials and equipment from various locations. Tower cranes are supported on a steel tower erected next to or inside a building's framework. They can only hoist materials positioned within the maximum radius of their lifting mechanisms.

A skyscraper's interior contains rentable space and service areas. Service areas include corridors, stairs, lobbies, elevators, and machine rooms. These areas provide such internal systems as plumbing, air conditioning, electrical systems, and elevators.

Plumbing systems consist of a water supply system and a drainage system. The water supply system brings clean water to plumbing fixtures. In a skyscraper, pumps increase the pressure within the pipes so that water reaches the upper floors of the building. The drainage system carries away water and waste materials.

Air conditioning systems control the temperature within skyscrapers. Most air conditioners used in large buildings heat air by blowing it over coils filled with hot water or steam. A boiler heated by a gas or oil burner produces the hot water or steam. To cool the air, most air conditioners blow the air over coils filled with cold water or a chemical refrigerant.

The air conditioning system then circulates the warmed or cooled air throughout the skyscraper. Fans blow conditioned air into a room through ducts. Other fans return used air and blow some of it out of the building.

Electrical systems provide power and communication systems. In many skyscrapers, power from the local utility company enters at the base of the building. Wires carry the electricity to each floor and supply power for lighting, office equipment, and other purposes. In some skyscrapers, builders mount a second floor on top of the structural floor to create a space for wiring needed for telephone, computer, and power systems.

Elevators in skyscrapers travel at speeds as high as 600 meters per minute. A group of elevators typically serves a zone of 15 to 20 floors. Some tall buildings have express elevators that travel nonstop to certain floors called sky lobbies**,** where passengers change to local elevators. The local elevators then carry the people to their floors.

Rotating Skyscrapers. Renowned Italian architect Dr. David Fisher is the creator of the Dynamic Tower project, a building in motion in Dubai. The brightest feature of the building was to be the rotation of most floors around the central core, which would allow the building to change the form constantly. Another characteristic feature of the building was the system of connection of pipelines: all engineering systems of the central core were to be connected to the rotating parts of floors, which would allow to use water, electricity, heating and the sewerage in the apartments in a habitual mode. The Dynamic Tower was to be environmentally friendly, with the ability to generate electricity for itself as well as other buildings nearby making it the first building designed to be self-powered. It would achieve this feat with wind turbines fitted between each rotating floor. The Dynamic Tower project is also the first skyscraper to be built entirely from prefabricated parts that arrive at the building site ready for quick and efficient installation. This approach requires far less workers on the construction site than traditionally.

But it turns out that even highly-developed countries do not have enough resources to implement some projects. Several reasons stood in the way of the project implementation at once: the fabulous cost of construction, problems in practical implementation, as well as the results of preliminary sales, which clearly showed that almost no one wanted to buy real estate in a moving skyscraper.

Activity 2: Answer the question to the text

1. What is the origin of the word «skyscraper»?
2. Where were the first skyscrapers constructed?
3. Why did the first skyscrapers appear?
4. What famous skyscrapers do you know?
5. What cranes are used in the construction of the skyscrapers?
6. What two main parts do skyscrapers have?
7. What is the difference between the construction of a skyscraper and a building less than four stories high?
8. What do the beams, girders, and columns in a skyscraper do?
9. Why did the Dynamic Tower appear to be unimplemented project?

Activity 3: Write an abstract to the text and retell it

Activity 4: *Resume the text in a few sentences starting with*

This text is about ……

The main attention is given to ……

It can be interesting for …….

8.1 Grammar focus

Step 1: Revision of the rules

Table 8.1 – Modals and semi-modals

Modals and semi-modals		
Prohibition, rules and laws	can't / must not	We **can't / must not** park here
Obligation (personal or external) or necessity	Must / mustn't / have to/need to	You **must** follow the rules of the game. Do I **need to** take this medicine before a meal?
Lack of obligation or necessity	don't have to needn't / don't need to	We **don't need to** obey the law if it doesn't make sense
Past obligation	had to	I **had to** complete my work on time
Lack of past obligation	needn't + perfect infinitive / didn't have to / didn't need to	You **needn't have brought** / **didn't need to** bring dessert
Certainty about now or generally	must can't couldn't	I **must** be right about this. He **can't/couldn't** be the one we're looking for
Certainty about the past	must /can't / couldn't + perfect infinitive	They **must have heard** by now. We **can't/couldn't have written** that in 10 minutes
Probability about now, future or in general	should/ought to	The weather **should** be good tomorrow
Probability about the past	should/ought to+ perfect infinitive	He **should have arrived** at 10
Possibility about now, future or in general	could may/might	I **might** see you tomorrow. If we don't hurry, we **could** be late
Possibility about the real past	could/may/ might+ perfect infinitive	He **may have missed** the bus. The road **might have been** blocked

Step 2

a) Fill in the blanks using CAN, CAN'T, MUST, HAVE TO, MIGHT, MAY

1. Rose and Ted ……. be good architects. They have won hundreds of prizes.

2. You …… pay to use this graphic design tool. It's free.

3. If the soil becomes too watery, protective walls …… be built so the work can continue.

4. This ……be the tallest building in this city! I have seen a taller one!

5. Engineers …… identify the soil types present in the area before the design the foundation.

6. Any excavation that ……. cave in is braced and shored with wood or steel.

7. Noise pollution ……. well decrease the value of the house.

в) Rewrite the sentences without changing their meaning

1. It's possible that Norman Foster will design some districts in Kharkiv.

Norman Foster …… some districts in Kharkiv.

2. Look at this trench! The foundation definitely isn't ready yet!

Look at this trench! The foundation …….. ready yet!

3. It isn't necessary for you to build a structural floor for wiring and communication systems. You …….. a structural floor for wiring and communication systems.

4. I'm sure that Mrs Smith didn't use prefabricated parts for this home.

Mrs Smith …….. prefabricated parts for this home.

5. It is forbidden to build in protected areas like national parks or wilderness areas. You ……. in protected areas like national parks or wilderness areas.

c) Choose the correct answer

While designing the skyscraper, it is necessary to be prepared for the unexpected effects that (1)……. arise in the future. Relationships with surrounding buildings (2)……. improve the cityscape by positively influencing the skyline. Both inside and outside of the skyscrapers (3)……. be well designed so that those who use the building and those who observe from the outside do not have problems. Skyscrapers (4)…….be weight-bearing, earthquake and wind-resistant, and safe living spaces that (5)…….protect from fire throughout their lifetime. They consume a lot of energy, and you (6)……. need mechanical ventilation.

1. A. should	B. have to	C. may	D. must
2. A. can	B. must	C. ought to	D. can't
3. A. is able to	B. should	C. can	D. has to
4. A. can	B. had to	C. should	D. may
5. A. ought to	B. can	C. may	D. might
6. A. can	B. have to	C. ought to	D. may

Glossary

Abbreviations: **adj.** = adjective – прикметник; **adv.** = adverb – прислівник; **pl.** = plural – множина; **pp.** = past participle – дієприкметник; **n.** = noun – іменник; **v.** = verb – дієслово; **prep**=preposition – прийменник

access *(n)*	доступ
blasting *(n)*	вибухові роботи
bolt-up *(v)*	закрутити
coil *(n)*	котушка, теплообмінник
core *(n)*	ядро
derrick *(n)*	дерік-кран
duct *(n)*	повітровід
entirely	повністю
erect *(v)*	будувати
fan *(n)*	вентилятор
habitual *(adj)*	звичний
hoist *(n)*	підіймальник
implement *(v)*	реалізувати
irrespective *(adv)*	незалежно
merely *(adv)*	просто
preliminary *(adj)*	попередній
proper *(adj)*	належний
pump *(n)*	насос
ratio *(n)*	співвідношення
refer *(v)*	посилатися
renowned *(adj)*	відомий
scarce *(adj)*	дефіцитний
temporarily *(adv)*	тимчасово
underneath *(prep)*	внизу
warehouse *(n)*	склад
welder *(n)*	зварювальник

UNIT 9

Building a House

Activity 1: Fill in the gaps with the words given

roofing asphalt, the frost line, extra room, concrete piers, poured concrete, wooden sills, floorboards, bottom layer, to nail (something) together, slanted roofs, final layer, window sashes, moisture, concrete block

1. The attic was converted into ……for the family to use.

2. The carpenter installed …… around the windows to keep out the cold air.

3. We had to use a dehumidifier to reduce the …… in the basement.

4. The house had a …… which allowed for more headroom inside.

5. Our architect decided to paint the …… to match the color of the house.

6. The bridge was built on …… to keep it from sinking into the riverbed.

7. The builders had to take …… into account when laying the foundation for the house.

8. The …… of plaster was applied to give the wall a smooth finish.

9. The workers spread the …… over the entire surface of the roof.

10. We had …… the pieces of wood …… before we could paint them.

11. Builders generally use concrete or ……for the house's foundation.

12. It is necessary to wait for the …… to dry before you can start building on top of it.

13. The …… creaked as I walked across the room.

Activity 2: Read the text given below

If a person decides to build a house, he or she must first select a lot, or piece of land. The next step is to consult an architect or builder. This expert will check local zoning laws and electrical, building, and plumbing codes. Knowledge of these codes protects the buyer in both the present and the future. For example, the zoning law in the area may permit the construction of factories near the new house. Such construction might well decrease the value of the house.

The foundation supports the house. First, construction workers begin excavating, or digging, holes or trenches for the footings, the lowest part of the foundation. The footings support each wall load. They are made by pouring concrete into wood or steel forms that workers place below the frost line, or the depth to which the ground freezes. This is done so that the footings will not freeze and shift. Footings usually extend from 1 to 6 feet (30 to 180 centimeters) beneath ground level. Builders generally use concrete or concrete block for the house's foundation. The foundation may extend from 8 inches to 3 feet (20 to 91 centimeters) above the ground. The area within the foundation below the first story is the basement. Basements add to the cost of building a house, but they provide extra room. Many basements have separate rooms for the home's heating unit and laundry equipment, and for storage. Some basements also have a recreation room.

In many low or damp regions, houses are raised above the ground on concrete piers. Sometimes a slab foundation is laid directly on the ground, especially if the earth beneath the house is hard. The ground must first be leveled. Workers then spread a filler, usually stone, and cover it with a moisture proof paper. The filler and the paper prevent moisture from coming through the slab that is made by pouring concrete, about 4 inches (10 centimetres) thick, directly on top of the paper.

The frame is the skeleton around which the rest of the house is built. After the footings and foundation have been formed, workers bolt wooden sills to the foundation. The sills support the outside walls. Floor joists, or support beams, are attached to the sills about 16 inches apart. A joist runs from one sill and joins with another joist from

the opposite sill. They meet at a girder (main support beam) or basement wall about midway between the house's sides. Floor boards or plywood nailed on top of the joists make the bottom layer of the floor. The structure is then solid enough to hold the wall frames of the house.

Wall frames include vertical pieces of lumber called studs and horizontal pieces called plates. Carpenters assemble and nail together each wall frame separately before attaching it to the sill. Then they lift each frame into place and brace it temporarily. When all the outside walls have been raised, they are nailed together and braced permanently. The sheathing, or inner layer of the outside walls, may be wood, fibreboard, or plasterboard nailed to the studs. Siding may be aluminium, brick, stone, or wood placed directly over the sheathing or tar paper.

The roof seals the top of the house. Some roofs are flat, but most are slanted. Slanted roofs are often formed by pieces of lumber called rafters. Carpenters nail the bottom ends of the rafters to the plates at the top of the outside wall. The rafters slant from the plates and meet at the ridge board, a board placed at the ridge, or top edge, of the roof. Rafters support the weight of the roof just as joists support the weight of the floor. There are many variations of flat and sloping roofs. A gable roof has two sides sloping up to a center ridge. The hip roof has four sides sloping up from all four walls. The lean-to is a single slope over a small building, usually set against a larger building. A gambrel roof has two added ridges parallel to the center gable ridge, making steep slopes below each side of the upper, flatter slopes. Mansard roofs also have ridges below the center one, but on four sides, like the hip roof. Water is drained beyond the walls of a building by the eaves of the roof.

After carpenters nail sheathing to the tops of the rafters, they add heavy building paper or building felt to it. Then they add the final layer of asphalt or slate shingles, or roofing asphalt. Flashing, or strips of sheet metal, placed around the chimney and other roof openings, insulates the roof from the chimney and also prevents water from leaking into the house.

Interior construction includes floors, walls, windows, and doors. Floors have two layers. The lower layer lies at an angle across the floor joists. The upper, finished layer is

made from tongue and groove boards. One side of each board has a tongue and the other side has a groove, or slot. The tongue of one board fits snugly into the groove of another board. Most finished floors are made of hardwoods, such as maple or oak, that have been finely sanded and later sealed with a wood filler. The wood may then be finished with wax, shellac, varnish, or plastic. Other floors have such coverings as linoleum or rubber, vinyl, or asphalt tile.

Rooms are made by building inside walls after the outside walls have been attached to the foundation. Inside walls, also called partitions, are really small-sized frames like the outside walls. They have studs and must be supported by plates, joists, and girders. If plaster is to be applied, the interior walls must first be covered with lath, or strips of wood, metal, or plasterboard. Wallboard, plasterboard, or plywood may be used in place of plaster.

Most parts of a window come from a lumber mill, already cut in the proper sizes. Carpenters leave space in the frame for windows and sashes. Window sashes are made of wood or metal, usually either aluminum or lightweight steel.

Both doors and door frames may usually be bought ready-made. Carpenters attach the doors high enough to swing over rugs or carpets.

Electrical wiring provides lighting and furnishes outlets for lamps, washing machines, and other appliances. In some houses, electricity also provides heat. Before construction starts, the builder determines the location and type of wiring. Electricians install wiring while carpenters build the frame.

During construction, plumbers install the pipes that will supply gas and water, and carry away waste. They install bathroom fixtures and sinks just before other workers add the finishing touches to the house.

Insulation reduces the amount of heat or cold that passes through walls, floors, and ceilings. It is made from many materials, including cellulose, rock wool, a glassy lava called perlite, gypsum, certain plastics, fiberglass, etc. The type of insulation used depends on the climate and on whether it insulates floors, ceilings, or walls.

Most houses have central heating systems. One furnace, or heating unit, supplies heat for the entire house. Such houses are heated by warm air, steam, or hot water. Air conditioning units may be used to cool and heat houses.

Activity 2: Answer the question to the text

1. Who designs and supervises the construction of the building?
2. What does the foundation do?
3. Why are the footings placed below the frost line?
4. What is the basement?
5. What types of roofs do you know?
6. How does electrical wiring benefit a house?
7. Who determines the location and type of wiring before construction begins?
8. When do plumbers typically install bathroom fixtures and sinks?
9. What is insulation used for?

Activity 3: Write an abstract to the text and retell it

Activity 4: *Resume the text in a few sentences starting with*

This text is about ……

The main attention is given to ……

It can be interesting for …….

9.1 Grammar focus

Step 1: Revision of the rules

Table 9.1 – Adjective comparative superlative

	adjective	**comparative**	**superlative**
regular adjectives with one syllable	soft b**ig** (ending vowel+consonant)	+ er soft**er** big**ger** (double final letter)	the…+ est the soft**est** the big**gest** (double final letter)
regular adjectives with 2 syllables (ending – y)	happy	happ**ier** **(y is replaced with i)**	the happ**iest** **(y is replaced with i)**
regular adjectives with 2 or more syllables	beautiful	**More / less** beautiful	**the most / least** beautiful
irregular adjectives	good bad far much / many little	better worse farther / further more less	the best the worst the farthest / furthest the most the least

Table 9.2 – Structures used to make comparisons

Structures used to make comparisons:	**(not) as…….as**	Plastic is **not as** strong **as** iron.
	the……., the	**The** richer you are, **the** more you want.
	too + adjective	He is **too young** to start working.
	adjective+enough	He is not **old enough** to start working.

Step 2

a) Complete sentences using comparative forms of the words in capitals

1. This skyscraper is much ……... (HIGH) than that.
2. The gable roof is ……... (POPULAR) in the USA than the flat one.
3. Wood is ……... (MOISTURE-PROOF) than concrete.

4. Why don't we try and find a …….. (CHEAP) floor covering than marble tiles.

5. The car was made from aluminium to make it …….. (LIGHTWEIGHT).

6. The slab foundation is …….. (COST-EFFICIENT) than pier and beam foundation.

в) Choose the correct form of adjective

Foundation is one of the essential parts of the structure. Generally, if the width of the foundation is (1) **the greatest / greater** than the depth, it is labeled as the «Shallow Foundation». If the width is (2) **smaller / less small** than the depth of the foundation it is called a «Deep Foundation». As the shallow foundation depth is low and it is economical, it is (3) **as popular as / the most popular** type of foundation for lightweight structures. Pile foundation is used to transmit foundation loads to (4) **deeper / the deepest** soil or rock strata when the bearing capacity of soil near the surface is relatively low. Pier is an underground structure that transmits a (5) **more massive / less massive** load, which cannot be carried by shallow foundations. It is usually (6) **the shallowest/shallower** than piles. There are many ways to do a pier foundation. Masonry is (7) **the most convenient / more convenient** way among them.

c) Complete the second sentence using the word given, so that it has a similar meaning to the first sentence. Use between two to five words in each gap

1. Spray foam is better for insulation than rock wool. NOT

Rock wool is …….. as spray foam.

2. Vinyl flooring is too polluting to be so widely used. ENOUGH

Vinyl flooring is ……..to be so widely used.

3. It was the most expensive project he has worked on. NEVER

He has ……. such an expensive project.

4. If they dig dipper trench, the foundation will have higher bearing capacity.

The dipper trench they dig, ……. the foundation will have.

5. Wooden sills are not durable enough for wet climates. TOO

Wooden sills ……. for wet climates.

Glossary

Abbreviations: **adj.** = adjective – прикметник; **adv.** = adverb – прислівник; **pl.** = plural – множина; **pp.** = past participle – дієприкметник; **n.** = noun – іменник; **v.** = verb – дієслово

code *(n)*	кодекс, норми
damp *(adj)*	вологий
decrease *(v)*	зменшувати
extend *(v)*	розширити
felt *(n)*	фетр
footing *(n)*	опора, основа
furnace *(n)*	піч
gable *(adj)*	двосхилий
gambrel *(adj)*	мансардний
hardwood *(n)*	деревина твердих порід
hip *(adj)*	шатровий
joist *(n)*	балка
laundry *(n)*	прання
lean-to *(adj)*	односхилий
level *(v)*	вирівнювати
lumber *(n)*	пиломатеріали
mansard *(adj)*	мансардний
maple *(n)*	клен
nail *(v)*	прибити
outlet *(n)*	розетка
permit *(v)*	дозволяти
plasterboard *(n)*	гіпсокартон
pour *(v)*	заливати
rafter *(n)*	крокви
ridgeboard *(n)*	конькова дошка
sashe *(n)*	стулки
sheathing *(n)*	обшивка
shift *(v)*	зсувати, змістити
sill *(n)*	підвіконня
slab *(n)*	плита
slanted *(adj)*	похилий, скошений
stud *(n)*	шпилька
tongue *(n)*	язичок, шпунт

UNIT 10

Types of construction

Activity 1: Match A and B to make the word combinations

A	B
infrastructure	roofs
multi-family	sound
comfortable	requirement
power	spaces
supply	construction
internal	plants
bearing	concrete
fire-	house
lightweight	partition
non-	space
wooden	resistant
reinforced	lines
void	combustible
dimensional	masonry
flammable	wall
structurally	wood

Write down the word combinations into the box

Activity 2: Read the text given below

Construction, also referred to as building construction, means any activities on a site requiring special skills, techniques, and companies involved in the assembly and erection of used structures. The four main types of construction are: residential construction, commercial construction, industrial construction, and infrastructure construction.

Residential construction. It is the process of constructing a single or multi-family house for beauty, comfort, utility, and durability. A residential building should be a comfortable space where human beings can survive and thrive.

Commercial construction. It is the process of designing, building, or renovating commercial structures that can be leased or sold as office spaces, storage shelters, or warehouses.

Industrial construction. It is constructing premises or structures that can be used for manufacturing, such as factories, power plants, warehouses, and processing plants.

Infrastructure construction. This is the construction, renovation, and maintenance of public and private physical structures such as roads, bridges, railways, pipelines, electricity supply lines, water supply lines, tunnels, and dams to provide shelter.

We use buildings daily; however, most people need to learn how to construct them or the type of construction that influenced them. Construction type refers to how a building is resistant to fire. This includes all the structural members and non-load-bearing components of the building. The choice of materials and design of a structure affect a building's resistance to fire, earthquakes, and other related phenomena, thus affecting the construction type. There are five major construction types widely recognized in the construction industry.

The construction type also affects a building's resilience to unforeseen catastrophes like hurricanes and earthquakes. In the same way, construction workers are wary of accidents during construction; they should be aware of how their work affects the building's future safety. At first glance, most buildings look similar.

However, the underlying materials primarily affect the durability of a building. We classify projects from Type 1 to 5, depending on how fire-resistant a structure is.

Type 1: Fire-resistive. Generally speaking, Type 1 buildings are high-rise residential and commercial spaces. These buildings are made mostly from concrete and steel, and we classify them as the most robust during a fire. They can withstand high temperatures for a long time. These ratings apply to roof and floor assemblies, internal partitions, and bearing and support walls. The strengths of these buildings are that they are not vulnerable to collapse and are fire-resistant for up to four hours. The weakness of these buildings is if they are made of steel, they wear down over time due to corrosion. The roofs and windows of these buildings are also not easily penetrable five times. Some of these buildings have pressurized stairwells to curb the spread of fire.

Type 2: Non- combustible. Most modern «big box» stores and shopping malls qualify as Type 2 buildings. We make these buildings from lightweight concrete, metals, and masonry, which are primarily non-combustible. However, combustible materials might be present, such as foam and rubber. These buildings have sound fire suppression systems but are prone to collapse, mainly because of their types of roofs. In a fire, firefighters try to ventilate the building to mitigate flashovers which are sudden temperature increases. These buildings burn for one to two hours, depending on the type of materials used in construction. The materials of these buildings are slow-burning, which ends up adding fuel to the fire. In a fire, firefighters ventilate these buildings using roll-up doors or skylights to a building's exterior.

There are significant differences between type 1 and type 2 buildings. Type two buildings are susceptible to expansion, relaxation, and distortion of steel members resulting in an almost total collapse in case of fire. The interior partitions of these buildings are from non-combustible materials and some limited approved combustible materials.

Type 3: Ordinary type. We also refer to these building structures as brick and joist structures. These structures have walls made from bricks or masonry, wooden roofs, and floor fire-protected fire protection. In most cases, all or part of the interior

elements, such as frames, floors, and ceilings, are made from combustible materials. All type three buildings have wooden roofs, but conventionally, older type 3 buildings have framed roofs, but new buildings have lightweight roofing systems. The walls are either reinforced masonry or concrete. Some of these buildings are schools, residential and small commercial buildings. An advantage of these buildings is that their combination of materials allows them to stay standing even if floors collapse. Their major weakness is that many connected attics or void spaces enable fire to spread rapidly.

Type 4: Heavy timber type. Most of the buildings constructed before 1960 were heavy timber-type buildings. Firefighters easily recognize them as they have timber walls and roof spans. The timber members are solid or laminated and must fit dimensional requirements. Examples of such buildings are old factories, churches, barns, and residential houses. Structural supports such as beams, arches, and columns require a minimum of eight inches for these construction types. Sometimes these buildings may have non-combustible load-bearing walls. Most of the connections are metal joint connections that fail quickly during fires. In the case of factories, oil, goods, and materials can increase the severity of the fires. Large dimensional timber buildings hold up well during fires, but damage from weather and termites increases their risk of collapse.

Type 5: Wood-framed type. Many new modern homes are Type 5 construction types. This is because they use combustible materials for the walls and roof. Unlike the large-dimension wood used in heavy timber-type buildings, we make these structures from lightweight or flammable manufactured wood. This construction is easy to set up, inexpensive, and structurally sound. It, however, is not fire-resistant and collapses within minutes in the event of a fire. However, firefighters can deal with these buildings as they are well-ventilated from the wood frames. This is a disadvantage as the fire spreads rapidly due to high ventilation. One way to prevent the collapse of these buildings is by using big timber members for the main structural elements. These structures have deficient fire-resistant properties.

Activity 2: Answer the question to the text

1. How does residential construction differ from commercial construction in terms of the purpose of the building?
2. What kinds of structures can be built through industrial construction, and what is their intended use?
3. How does infrastructure construction contribute to the functioning of the economy?
4. How does a construction type affect its ability to withstand natural disasters?
5. Why is it important for construction workers to be aware of a building's future safety?
6. What are the strengths and weaknesses of a Type 1 building in the event of a fire?
7. Why are Type 2 buildings prone to collapse in a fire?
8. What is the major weakness of Type 3 buildings?
9. How can the collapse of Type 5 buildings be prevented?

Activity 3: Write an abstract to the text and retell it

Activity 4: *Resume the text in a few sentences starting with*

This text is about ……

The main attention is given to ……

It can be interesting for …….

10.1 Grammar focus

Step 1: Revision of the rules

Table 10.1 – general & special questions

Questions	
Be is the main verb	**Are / were** you (they, we) at home? / **Am / was** I happy?
Be is an auxiliary verb	**Am / was** I watching TV? / **Is / was** she (he, it) working?
Have is an auxiliary verb	**Have / had** I (we, you, they) got a parcel? **Has / had** he (she, it) been there?
Have and all **other verbs** as a main verb	**Do / did** I (you, we, they) **have** enough time? **Does / did** she (he, it) **pay** for it?
Modals	**Can** I sit here? **Could** you help?
With the questions words **who, what, where, when, why, how, how many**, etc.	**Who helped** you? (question refers to the *subject*) **Who did** you **help**? (question refers to the *object*) **Where did** you **go** last summer? **Why is** she **crying**?

Table 10.2 – disjunctive questions

Question tags	
Be as the main verb	You **are** British, **aren't** you?
With an **auxiliary verb** in the statement	James **is** working there, **isn't** he?/ The phone **didn't** ring, **did** it?
No **auxiliary verb** in the statement	Mia **eats** cheese, **doesn't** she?/I **said** that already, **didn't** I?
With **Let's**	**Let's** go for a walk, **shall** we?
With **imperatives**	Close the window, **will you?/** Don't forget about it, **will you?**

Table 10.3 – embedded questions

Indirect questions: introductory phrase + clause with **normal word order**	
Can you tell me….? / Could you let me know…..?	Can you tell me **what time it is**?
Do you know…? / I wonder…...? / I wish I knew…	Do you know **when the film finishes**?

Step 2:

a) Read the questions and decide if they are to the object (O) or to the subject (S) of the sentence

1. Who built this office space for you?
2. What materials did they use to ensure fire-resistance?
3. What is kept in these warehouses?
4. Who should be aware of how their work affects the building's safety?
5. What is the contractor doing?
6. Who is looking for a multi-family house?
7. Who are you building this multi-family house for?

в) Ask for the underlined part

1 Lightweight concrete has improved *sound absorption*.
2. It is important to store combustible materials *properly* to prevent fire hazards.
3. Commercial projects often involve *multiple contractors and subcontractors*.
4. *Engineers* consider the design and placement of load-bearing components.
5. *A house extension project* generally requires various permits and inspections.
6. Beams and columns are essential *for the stability of a building.*
7. The building's fire-resistance prevented the spread of flames *during a recent fire*.

c) Choose the correct answer

1. Did he ……. about designer's meeting? A. told C. tell B. tells D. has told	4. Let's build a new shopping mall, ……? A. will we C. let's we B. shall we D. can you
2. A family invested a lot in a house extension, ……...? A. haven't they C. did they B. didn't they D. are they	5. Do you have any idea when will ……? A. the road be built C. the road be building B. be the road built D. the road built
3. Could you tell me, ……..? A. where is the plant C. where the plant B. what is the plant D. where the plant is	6. Don't use flammable wood for the roof, …….? A. shall you C. will you B. do you D. don't you

Glossary

Abbreviations: **adj.** = adjective – прикметник; **adv.** = adverb – прислівник; **pl.** = plural – множина; **pp.** = past participle – дієприкметник; **n.** = noun – іменник; **v.** = verb – дієслово

assembly *(n)*	збірка, монтаж
attics *(n)*	мансарда
barn *(n)*	сарай
collapse *(v)*	впасти, звалитися
curb *(v)*	приборкати, стримати
distortion *(n)*	спотворення
durability *(n)*	довговічність
flammable *(adj)*	горючий
foam *(n)*	піна
hold up *(v)*	триматися
lease *(n)*	оренда
maintenance *(n)*	обслуговування
mitigate *(v)*	пом’якшити
penetrable *(adj)*	проникаючий
prone *(adj)*	схильний
rapidly *(adv)*	швидко
resilience *(n)*	стійкість
resistant *(adj)*	стійкий
robust *(adj)*	міцний
roll-up *(adj)*	рулонний
severity *(n)*	тяжкість
shelter *(n)*	укриття, сховище
sound *(adj)*	міцний
stairwell *(n)*	сходова клітка, майданчик
susceptible *(adj)*	сприйнятливий
thrive *(v)*	процвітати
underlying *(adj)*	базовий, основний
void *(adj)*	порожній
vulnerable *(adj)*	вразливий
wear down *(v)*	зношуватися

UNIT 11

Industrial construction

Activity 1: Complete the following sentences with the definitions given

commercial property, construction industry, for-profit firm, design team, bill of quantities, surveyor, fire protection engineer, one-stop shopping, residential district, performance, on-site construction, a bid

1. ……. is a document that lists the materials, labor, and other costs associated with a construction project.

2. ……. is a professional who measures and maps land, buildings, and other features of the earth's surface.

3. ……. is an area of a city or town that is primarily composed of residential buildings.

4. ……. is a business that seeks to generate profits for its owners or shareholders.

5. ……. is the act of executing a task or activity, usually in relation to a standard of quality or quantity.

6. ……. is real estate that is used for business purposes, such as offices, retail stores, and warehouses.

7. ……. is the sector of the economy that involves the building and maintenance of infrastructure such as roads, bridges, dams, and buildings.

8. ……. is a group of people who work together to create a product or service.

9. ……. is an offer to do a job or provide a service at a certain price.

10. ……. is the process of constructing a structure at its intended location.

11. ……. is a professional who specializes in designing and implementing systems to protect people and property from the dangers of fire.

12. ……. is a term used to describe a business or service that provides customers with all of their needs in one place.

Activity 2: Read the text given below

Industrial construction refers specifically to buildings or structures that have an intended use in industrial fields. Mainly, these are larger industrial projects like factories, warehouses, power plants, and other specialized facilities like solar farms and commercial properties. Processes in these industries require highly specialized expertise in planning, design, and construction. As in building and heavy/highway construction, this type of construction requires a team of individuals to ensure a successful project. Industrial construction, though a relatively small part of the entire construction industry, is a very important component. Owners of these projects are usually large, for-profit, industrial corporations.

Industrial and commercial construction are often confused with each other. As mentioned before, industrial construction involves constructing a building used to manufacture goods and products. On the other hand, commercial construction means constructing a building to house a business – grocery and retail stores, restaurants, sports facilities, private schools and hospitals are commercial buildings.

In the modern industrialized world, construction usually involves the translation of paper or computer based designs into reality. A formal design team may be assembled to plan the physical proceedings, and to integrate those proceedings with the other parts. The design usually consists of drawings and specifications, usually prepared by a design team including architects, interior designers, surveyors, civil engineers, cost engineers (or quantity surveyors), mechanical engineers, electrical engineers, structural engineers, and fire protection engineers. The design team is most commonly employed by (i.e. in contract with) the property owner. Under this system, once the design is completed by the design team, a number of construction companies or construction management companies may then be asked to make a bid for the work, either based directly on the design, or on the basis of drawings and a bill of quantities provided by a quantity surveyor. Following evaluation of bids, the owner will typically award a contract to the lowest responsible bidder.

The modern trend in design is toward integration of previously separated specialties, especially among large firms. In the past, architects, interior designers,

engineers, developers, construction managers, and general contractors were more likely to be entirely separate companies, even in the larger firms. Presently, a firm that is nominally an «architecture» or «construction management» firm may have experts from all related fields as employees, or to have an associated company that provides each necessary skill. Thus, each such firm may offer itself as «one-stop shopping» for a construction project, from beginning to end. This is designated as a «design build» contract where the contractor is given a performance specification, and must undertake the project from design to construction, while adhering to the performance specifications.

Several project structures can assist the owner in this integration, including design-build, partnering, and construction management. In general, each of these project structures allows the owner to integrate the services of architects, interior designers, engineers, and constructors throughout design and construction. In response, many companies are growing beyond traditional offerings of design or construction services alone, and are placing more emphasis on establishing relationships with other necessary participants through the design-build process.

The increasing complexity of construction projects creates the need for design professionals trained in all phases of the project's life-cycle and develop an appreciation of the building as an advanced technological system requiring close integration of many sub-systems and their individual components, including sustainability. A construction project must fit into the legal framework governing the property. These include governmental regulations on the use of property, and obligations that are created in the process of construction.

The project must adhere to zoning and building code requirements. Constructing a project that fails to adhere to codes will not benefit the owner. Some legal requirements come from the desire to prevent things that are indisputably bad-bridge collapses or explosions. Other legal requirements come from things that are a matter of custom or expectation, such as isolating businesses to a business district and residences to a residential district. An attorney may seek changes or exemptions in the law governing the

land where the building will be built, either by arguing that a rule is inapplicable, or that the custom is no longer needed.

A construction project is a complex net of contracts and other legal obligations, each of which must be carefully considered. A contract is the exchange of a set of obligations between two or more parties, but it is not so simple a matter as trying to get the other side to agree to as much as possible in exchange for as little as possible. The time element in construction means that a delay costs money, and in cases of bottlenecks, the delay can be extremely expensive. Thus, the contracts must be designed to ensure that each side is capable of performing the obligations set out. Contracts that set out clear expectations and clear paths to accomplishing those expectations are far more likely to result in the project flowing smoothly, whereas poorly drafted contracts lead to confusion and collapse.

Legal advisors in the beginning of a construction project seek to identify ambiguities and other potential sources of trouble in the contract structure, and to present options for preventing problems. Throughout the process of the project, they work to avoid and resolve conflicts that arise. In each case, the lawyer facilitates an exchange of obligations that matches the reality of the project.

Design, finance, and legal aspects overlap and interrelate. The design must be not only structurally sound and appropriate for the use and location, but must also be financially possible to build, and legal to use. The financial structure must accommodate the need for building the design provided, and must pay amounts that are legally owed. The legal structure must integrate the design into the surrounding legal framework, and enforces the financial consequences of the construction process.

Using innovative technology is essential for an industrial construction company. For example, industrial buildings often require complex fabrications and systems that are time-consuming to construct on-site. To maximize a client’s budget and increase their return on investment (ROI), many industrial construction companies utilize prefabrication construction. Prefabrication construction involves constructing parts of a structure at a separate location and then transporting them to

the site, where the structure will be fully assembled. Prefabricating many aspects of an industrial building can accelerate the construction process without sacrificing the quality of work.

Activity 2: Answer the question to the text

1. How does industrial construction differ from other types of construction?
2. Who can usually be owners of industrial construction projects?
3. Why is industrial construction an important component of the construction industry?
4. What is a design team? What specialists does it include?
5. Who employs a design team?
6. What is «one-stop shopping» for a construction project?
7. What is a contract?
8. Why do design, finance and legal aspects overlap and interrelate in construction?
9. What is prefabrication construction, and how can it benefit an industrial construction project?

Activity 3: Write an abstract to the text and retell it

Activity 4: *Resume the text in a few sentences starting with*

This text is about ……

The main attention is given to ……

It can be interesting for …….

11.1 Grammar focus

Step 1: Revision of the rules

Table 11.1 – sequence of tenses

Direct speech	Reported speech	Example
present simple	past simple	I **don't play** football. – She said she **didn't play** football
present continuous	past continuous	I'**m eating**. – Tim said he **was eating**
present perfect	past perfect	I **have visited** my parents. – He said he **had visited** his parents
past simple	past perfect	We **lost** the match. – He told that they **had lost** the match
past continuous	past perfect continuous	I **was hoping** to find a job. – She said she **had been hoping** to find a job
will	would	I **will** need a car. – He said that he **would** need a car
can	could	I **can** swim. – She told us that she **could** swim
may	might	I **may** call him later. – She said that she **might** call him later

Table 11.2 – time expressions

Direct speech	Reported speech	Direct speech	Reported speech
here	there	now, at the moment	then, at that moment
tomorrow	the next/following day	next week, year, etc.	the following/next week
tonight	that night	last week, year, etc.	the week before
yesterday	the day before	ago	before, previously

Step 2

a) Turn sentences into direct speech

1. Tom said that the company was a for-profit firm.

……..……., said Tom.

2. The architect explained that the surveyor had already measured the property.

……...……., explained the architect

3. Bob told us that the client would ask for bids from several contractors the following week.

……...……...……., said Bob.

4. Ally announced that she was going to purchase commercial property.

……...……...……..……, announced Ally.

5. Paul said that he could send the bill of quantities. ……...……..…., Paul said.

в) Choose the correct form to complete the sentence

1. «My best friend became a legal advisor».

He told me that his best friend ___ a nurse first, then a paramedic.

A. was becoming;

B. had become;

C. has become.

2. «I had lived in four different residential districts by the age of ten».

She said that she ___ in four different residential districts by the age of ten.

A. lived;

B. was living;

C. had lived.

3. «We’ve assembled four prefabricated houses already».

He said that they ___ four prefabricated houses already.

A. were assembling;

B. have assembled;

C. had assembled.

4. «I love this design team! They are so talented!»

Chloe said she ___ that design team and they ___ so talented.

A. loves, were;

B. loved, were;

C. was loving, had been.

5. «The on-site construction of the bridge took several months to complete».

She said that the on-site construction of the bridge_____ several months to complete.

A. was taking;

B. has taken;

C. had taken.

Glossary

Abbreviations: **adj.** = adjective – прикметник; **adv.** = adverb – прислівник; **pl.** = plural – множина; **pp.** = past participle – дієприкметник; **n.** = noun – іменник; **v.** = verb – дієслово

accelerate *(v)*	пришвидшити
accommodate *(v)*	розмістити / пристосувати
accomplishing *(n)*	досягнення
adhere *(v)*	дотримуватися
ambiguity *(n)*	двозначність
appreciation *(n)*	визнання, оцінка
associated *(pp)*	пов’язаний
attorney *(n)*	адвокат
bid *(n)*	ставка
bottleneck *(n)*	вузьке місце
complexity *(n)*	складність
confuse *(v)*	плутати
consequence *(n)*	наслідок, результат
emphasis *(n)*	акцент, наголос
explosion *(n)*	вибух
goods *(n, pl)*	товари
grocery *(n)*	продуктовий магазин
indisputably *(adv)*	безперечно
intended *(pp)*	призначений
interrelate *(v)*	пов’язувати
obligation *(n)*	зобов’язання
overlap *(v)*	перекривати
proceeding *(n)*	розгляд
relatively *(adv)*	відносно
sacrifice *(v)*	жертвувати
seek *(v)*	шукати
smoothly *(adv)*	плавно
surveyor *(n)*	землемір, геодезист
sustainability *(n)*	стійкість, екологічність
time-consuming *(adj)*	трудомісткий, забирає багато часу

UNIT 12

Prefabricated Building

Activity 1: Match A and B to make the word combinations

A	B
to assemble	sales company
home	sections
steel	period
pre-assembled	regulations
to seek	on-site
permanent	homes
retail	huts
set-up	materials
transportable	into
settling-in	section
zoning	cracking
quonset	foundation
green	site
to incorporate	beam
drywall	opinion
mobile	crew

Write down the word combinations into the box

Activity 2: Read the text given below

Prefabricated building is a type of building that consists of several factory-built units that are assembled on-site to complete the unit. The term «prefabricated» may refer to buildings built in modules (modular homes) or transportable sections (manufactured homes), and may also be used to refer to mobile homes. Although similar in nature, the methods and design of the three can vary wildly. There are two-level home plans, as well as custom home plans.

Modular homes are homes that are created in sections, and then transported to the home site for construction and installation. These are typically installed and treated like a regular house, for both financing and construction purposes, and are usually the most expensive of the three. Although the sections of the house are prefabricated, the sections, or modules, are put together at the construction much like a typical home. Manufactured homes refer to homes that are built onto steel beams, and are transported in complete sections to the home site, where they are assembled. Mobile homes are, quite simply, mobile homes; that is, homes built on wheels, that are able to be moved from place to place.

Constructing manufactured homes typically involves connecting plumbing and electrical lines across the sections, and sealing the sections together. Manufactured homes can be single-, double-, or even triple-wide, which is simply a measure of how many sections wide it is. Many manufactured home companies manufacture a variety of different designs, and many of the floorplans are available online. Manufactured homes can be built onto a permanent foundation, and if designed correctly, can be difficult to distinguish from a stick-built home to the untrained eye.

Manufactured homes are typically purchased from a retail sales company that may be independently owned and operated, initially assembled by a local contracting company, and follow-up repairs performed by the manufactured home company under warranty. For this reason, customer service and reputation are extremely important. Purchasing a manufactured home from a disreputable or dishonest company can lead to lengthy delays in moving, as well as large residual and

unexpected costs. For this reason, it is advisable to seek second opinions or first-hand consumer opinions of a manufactured home brand.

A manufactured home, once assembled, goes through a «settling-in» period, where the home will settle into its location. During this period, some drywall cracking may appear, and any incorrectly installed appliances, wiring, and/or plumbing should be repaired, hopefully under warranty. If not covered under warranty, the costs will be borne by the consumer. For this reason, it is important that the consumer ensure that a reputable and honest contractor is used for the initial set-up. If any repairs are not completed by the initial set-up crew, the manufacturer will send repair crews to repair anything covered by the warranty. Just because a manufactured home has been assembled does not mean it is immediately inhabitable; appropriate ventilation, heating, plumbing, and electrical systems must be installed correctly by the initial set-up crew.

Mobile homes and manufactured homes can be placed in mobile home parks, and manufactured homes can also be placed on private land, providing the land is appropriately zoned for manufactured homes. Many cities have not updated zoning regulations for modern manufactured houses, and thus, may not permit manufactured houses to be placed in certain areas.

McDonalds use prefabricated structures for their buildings, and recently set a record of constructing a building and opening for business within 13 hours (on pre-prepared ground works). Prefabricated homes were first produced during the Gold Rush in the United States, when kits were produced in order to enable Californian prospectors to quickly and effectively construct living accommodation. Homes were available in kit form by mail order in the United States in 1908.

Prefabricated housing became increasingly popular during World War II due to the need for mass accommodation for military personnel. The United States used Quonset huts as military buildings, and in the United Kingdom there were a large number of prefabricated buildings used including Nissen huts and Bellman Hangars. «Prefabs» were built after the war as a means of quickly and cheaply providing quality housing as a replacement for the housing stock destroyed during the war.

Whole estates of prefabs were constructed to provide accommodation for those made homeless by the War and on-going slum clearance. Almost 160,000 had been built in the UK by 1948. The United States also used prefabricated housing, both to provide accommodation for its troops during the War, and for GIs returning home afterwards. Prefab classrooms were also popular with UK schools increasing their rolls during the baby boom of the 1950-s and 1960-s.

Prefabs were aimed at families, and typically had an entrance hall, two bedrooms (parents and children), a bathroom (a room with a bath) – which was a novel innovation for many British at that time, a separate toilet, a living room and an equipped (not fitted in the modern sense) kitchen. Construction materials included steel, aluminium, timber or asbestos, depending on the type of dwelling.

More and more architects are incorporating modern designs into the prefabricated houses of today. Prefab housing should no longer be compared to a mobile home in terms of appearance, but to that of a complex modernist design. There has also been an increase in the use of «green» materials in the construction of these prefab houses. Consumers can easily select between different environmentally friendly finishes and wall systems. Since these homes are built in parts, it is easy for a home owner to add additional rooms or even solar panels to the roofs. Many prefab houses can be customized to the client's specific location and climate, making prefab homes much more flexible and modern than before.

Activity 2: Answer the questions to the text

1. What is a prefabricated building?
2. What are the different types of prefabricated homes mentioned in the text?
3. How are modular homes constructed and treated for financing and construction purposes?
4. What are the characteristics of manufactured homes?
5. How can purchasing a manufactured home from a disreputable or dishonest company affect the consumer?

6. What is the «settling-in» period for a manufactured home, and what can happen during this period?

7. What is the history of prefabricated housing?

8. How were prefabs used after World War II in the UK?

9. How has the design of prefabricated houses changed in recent years?

Activity 3: Write an abstract to the text and retell it

Activity 4: *Resume the text in a few sentences starting with*

This text is about ……

The main attention is given to ……

It can be interesting for …….

12.1 Grammar focus

Step 1: Revision of the rules

Table 12.1 – reported questions&commands

Reported Questions	
1. When reporting a question, we use a reporting verb like **ask, wonder, or inquire, etc.** followed by **if** or whether. 2. The verb tense in the reported question changes according to the rules of reported speech. If the original question is in the **Present Tense**, we use the **Past Tense** in the reported question. If the original question is in the **Past Tense**, we use the **Past Perfect Tense** in the reported question. 3. The word order in reported questions is typically **subject + verb + object**	**Examples:** **Direct question:** What time is it? **Reported question:** She **asked** what time it **was.** **Direct Question:** Where did you buy that shirt? **Reported Question:** She **asked** me where **I had bought** the shirt. **Direct question:** Can you turn off the TV? **Reported question:** She asked me if I could turn off the TV
Reported Commands	
1. The verb tense changes from the imperative form to infinitive with 'to'. 2. The reporting verb can be omitted, and the word 'to' can be used instead. 3. The pronouns and possessive adjectives change to reflect the subject of the reporting clause	**Examples:** **Direct command:** Open the door, please. **Reported command:** She asked me **to** open the door. **Direct command:** Take this medicine three times a day. **Reported command:** He instructed me **to** take the medicine three times a day

Step 2

a) Turn the following questions into reported questions

1. Can mobile homes be placed on private land? (ask)

_____

2. Are manufactured homes permitted in certain areas? (ask)

_____

3. Do cities update zoning regulations for modern manufactured houses? (wonder)

_____

4. Has McDonald's set a record for constructing a building and opening for business within 13 hours? (ask)

_____

5. Were prefabricated homes first produced during the Gold Rush in the United States? (ask)

_____

6. Did homes become available in kit form by mail order in the United States in 1908? (want)

_____

7. Why did prefabricated housing become increasingly popular during World War II? (ask)

_____

в) Turn the following commands into reported commands

1. Place the mobile home in the mobile home park.

_____

2. Zone the land appropriately for manufactured homes

_____

3. Update zoning regulations for modern manufactured houses

_____

4. Construct the building and open for business within 13 hours.

_____

5. Produce kits to enable Californian prospectors to construct living accommodation.

_____

6. Use Quonset huts as military buildings.

_____

7. Build prefabs as a means of quickly and cheaply providing quality housing.

_____

Glossary

Abbreviations: adj. = adjective – прикметник; adv. = adverb – прислівник; pl. = множина; pp. = дієприкметник; n. = іменник; v. = дієслово

accommodation (n)	житло / проживання
appropriately (adv)	відповідно до / належним чином
bear (bore; borne) (v)	носити, нести
complete (v)	завершувати, закінчувати
consumer (n)	споживач
custom (adj)	*тут* замовлений, вибірковий
customer (n)	клієнт
delay (n)	затримка, припинення
distinguish (v)	відрізняти
drywall (n)	стіна сухого мурування
finish (n)	обробка
fitted (e.g.furniture) (pp)	вбудовані (наприклад, меблі)
flexible (adj)	гнучкий
GI (Government Issue) (n)	солдат
housing stock	житловий фонд
hut (n)	хатина; барак; казарма
Quonset hut (Am. En)	збірний будинок із гофрованого
Nissen hut (Br. En)	заліза;
incorporate (n)	містити
install (v)	установлювати
kit (n)	спорядження; набір
lengthy (adj)	розтягнутий
manufactured (pp)	промислово виготовлений
measure (n)	необхідна кількість, міра, межа
novel (adj)	*тут* невідомий, новий
online (adj, adv)	оперативний, оперативно
plumbing (n)	слюсарні роботи; прокладання труб
prefabricated (pp)	готовий; збірний
prospector (n)	старатель, золотошукач
residual (adj)	залишковий
sealing (n)	скріплення, стикування
set-up crew	команда з установки
schedule (v)	*тут* призначати
slum clearance	знесення старих будинків
warranty (n)	гарантія; запорука
wiring (n)	електропровід

UNIT 13

Green Building

Activity 1: Match A and B to make the word combinations

A	B
renewable	materials
negative	impact
energy	performance
thermal	yield
employee	traces
power	lighting
to leave	fuels
energy	use
balanced	construction
applicable	savings
sustainable	solution
low energy	productivity
efficient	legislation
low-pollution	insulation
environmental	lines

Write down the word combinations into the box

Activity 2: Read the text given below

Eco-friendly, or ecological, construction is building a structure that is beneficial or non-harmful to the environment, and resource efficient. Otherwise known as green building, this type of construction is efficient in its use of local and renewable materials, and in the energy required to build it, and the energy generated while being within it.

Eco-friendly construction has developed in response to the knowledge that buildings have an often negative impact upon our environment and our natural resources. This includes transporting materials hundreds or thousands of miles, which has a negative impact in the energy required to transport them, and also in emissions of hazardous chemicals from a poorly designed building that creates, and traps them.

The notion of Green building varies depending on the specialist. For eco-builders, it means a clean building, using natural materials. They consider that a building must above all adapt to humans, the well-being of its occupants being capital. These partisans of green building condemn the use of toxic substances in the industrial manufacture of construction materials. The damage to human health from asbestos insulation, laid out in rolls in thousands of UK homes, is now well known. Asbestos also takes hundreds of years to decompose in landfill.

Experts in energy savings aim to limit the negative impact of human habitat on the environment through ultra-modern technologies and to reduce the amount of energy consumed by buildings, houses and apartments. They recommend enhanced thermal insulation and leading-edge construction techniques. Eco-builders consider a building over its whole lifetime. Not only do they integrate energy savings, they also take into consideration the origin of the materials used and their management (elimination, recuperation) at the end of their life.

Eco-construction, also referred to as sustainable construction or green building, proposes various possibilities of reducing the environmental impact of buildings. Green building is not a specific construction method, but it brings together a set of techniques, materials and technologies which when suitably integrated in a construction project, contribute to enhancing its environmental performance. In an

ideal world, eco-construction optimizes energy efficiency, limits water consumption, makes maximum use of recycled, recyclable and non-toxic materials. It also generates as little waste as possible during the construction process and subsequent occupation.

In a green building, the structural creation processes respect the environment and make efficient use of resources. This practice is growing and complements the conventional concerns of designing buildings that are economical in energy, sustainable and comfortable. A green building is a clean, sustainable building, designed with natural materials, that uses little energy and is easy to maintain and which is available at a reasonable cost. Many options are now available to those wishing to design and build an eco-friendly dwelling. Architects, engineers and builders worldwide are now using construction techniques that have been developed throughout human history, in response to local environmental concerns and the physical resource opportunities available, coupled with 21st century technological refinements.

A green building is designed to reduce the overall impact of the built-up environment on human health and the natural environment, through:

1. The efficient use of energy, water and other resources.
2. Protecting occupant health and improving employee productivity.
3. Reducing waste, pollution and harm to the environment.

Effectively, a green building can incorporate sustainable materials (reused, recycled, recyclable, or from renewable resources) in its construction, create a healthy interior environment with a minimum of pollutants and functional landscape planning that requires less water (using indigenous greenery that thrives without additional watering). What is more, there is no clean habitat without a clean building site. To choose the right location, we must always start by considering the influences of the soil (contaminated sites, natural radioactivity, etc.) or the environment (noisome roads, industrial plants emitting toxic emissions, high voltage power lines) that may be troublesome. Installation in the route of a wind corridor, even within a large town, means the site will benefit from a pleasant atmosphere, rich in oxygen.

The choice of the site must be made according to natural data. In effect, topological data have a great influence on the micro-climate and therefore on the properties of a building site. So, in a basin where cold air stagnates, temperatures can be 6 °C below those on a flat terrain just a few hundred metres away. Architectural forms must be inspired by nature, with colours that do not seem artificial. Natural building techniques use the materials that nature provides. When these materials replace polluting synthetic products which consume a large quantity of energy in their manufacture, their use is highly recommended. The term «natural materials» essentially covers local (renewable) raw materials that can be used according to traditional craft methods or modern techniques. Green building uses resources efficiently. Its success is to leave fewer traces on the environment through the use of renewable energies and by ensuring high energy yield. This is a balanced solution between construction and a sustainable environment.

An eco-construction or green building approach aims to build in respect of our environment and that of future generations, while offering maximum comfort to occupants. It is also an approach that involves:

1. The identification of the environmental impacts of projects throughout their lifecycle.

2. The use of architectural and urban-planning techniques that prioritize natural light, integrate bio-climate principles, guarantee good thermal insulation of the whole building envelope and respect applicable legislation.

3. The use of «environmental» or «natural» materials that consume little energy in their manufacture, transport and deployment.

4. The promotion of the use of renewable energies and/or low-pollution fuels.

5. The use of «intelligent» equipment: «Low energy» lighting and household appliances, efficient correctly-sized heating systems.

Activity 2: Answer the question to the text

1. What is eco-friendly construction?
2. What are some of the negative impacts that buildings can have on the environment and natural resources?
3. What are the different approaches to green building?
4. What are some of the key techniques and materials used in sustainable construction?
5. How does eco-construction optimize energy efficiency and reduce water consumption?
6. What are the benefits of using recycled, recyclable, and non-toxic materials in building construction?
7. What factors should be considered when choosing the location for a green building project?
8. How can natural building techniques help reduce pollution and energy consumption?
9. How can green building improve occupant health and employee productivity?
10. What is the overall goal of eco-construction, and how does it contribute to a sustainable environment for future generations?

Activity 3: Write an abstract to the text and retell it

Activity 4: *Resume the text in a few sentences starting with*

This text is about ……

The main attention is given to ……

It can be interesting for …….

13.1 Grammar focus

Step 1: Revision of the rules

Table 13.1 – Passive Voice

In a passive voice construction, the grammatical subject of the clause receives the action of the verb	
Active voice: subject + verb (performed by the subject) + optional object. **Passive Voice**: subject + some form of the verb «to be» + past participle of a transitive verb + optional prepositional phrase	Examples: **Active Voice**: *The teacher* (subject) *explains* (verb) *the lesson* (optional object). **Passive Voice**: *The lesson* (subject) is {«to be») *explained* (past participle) *by the teacher* (optional prepositional phrase)
When we use the Passive Voice	
1. In broad statements about widely held opinions or social norms. 2. In reports of crimes with unknown perpetrators or other actions with unknown doers. 3. In scientific contexts. 4. When the writer or speaker wants to avoid blame. 5. In any other situation where you want to keep the focus on an action and/or the recipient of the action	*Tipping less than 20 percent is now considered rude*. *My car was stolen yesterday.* *The rat was placed in a T-shaped maze.* *Mistakes were made.* *The president was sworn in on a cold January morning*

Step 2

a) Fill in the gaps with the correct passive voice form

1. Eco-friendly construction _____ (know) as green building.
2. This type of construction _____ (develop) in response to the negative impact of buildings.

3. Buildings _____ (transport) hundreds or thousands of miles have a negative impact on the environment.

4. Green building _____ (consider) a clean building using natural materials.

5. The use of toxic substances _____ (condemn) by partisans of green building.

6. Experts in energy savings _____ (aim) to limit the negative impact of human habitat.

c) Rewrite the following sentences using the Passive Voice

1. Eco-friendly construction is building a structure that is beneficial or non-harmful to the environment.

_____

2. Green building is efficient in its use of local and renewable materials.

_____

3. Buildings have an often negative impact upon our environment and our natural resources.

_____

4. Hazardous chemicals are emitted from a poorly designed building that creates and traps them.

_____

5. Asbestos insulation, laid out in rolls in thousands of UK homes, is well known to cause damage to human health.

_____

6. Enhanced thermal insulation and leading-edge construction techniques are recommended by experts in energy savings.

_____

Glossary

Abbreviations: adj. = adjective – прикметник; adv. = adverb – прислівник; pl. = множина; pp. = дієприкметник; n. = іменник; v. = дієслово

beneficial (adj)	доброчинний
renewable materials	відновлювальні матеріали
impact (n)	вплив; наслідки
trap (v)	захоплювати
capital (adj)	головний; основний, найважливіший
partisan (n)	прихильник, поборник
condemn (v)	засуджувати
lay out (v)	викладати; розкладати
decompose (v)	розкладатися на складники
landfill (n)	звалище сміття
enhanced (adj)	посилений, збільшений
leading-edge (adj)	передовий; сучасний
elimination (n)	усунення; знищення, ліквідація
recuperation (n)	відновлення, рекуперація
coupled with	разом із
indigenous greenery	місцева флора
thrive (v)	цвісти, розростатися
contaminated (adj)	заражений, забруднений
noisome (adj)	шкідливий, нездоровий; смердючий
emit (v)	випускати, випромінювати, виділяти (тепло)
emission (n)	викид (тепла, запаху); вихлопи (автомобіля)
power line	лінія електропередачі
high voltage	висока напруга
stagnate (v)	застоюватися (про воду)
inspire (v)	надихати
traces (n)	слід, відбиток
energy yield	вихід енергії
building envelope	конструкція, яка обгороджує будівлю
applicable legislation	чинне законодавство
household appliances	побутова техніка

UNIT 14

New technologies

Activity 1: Match A and B to make the word combinations

A	B
shop	robotics
field	-aided
drilling	energy
cost	manufacturing
lean	platform
construction	professionals
Labour	productivity
Alternative	technology
Innovative	erection
seismic	Fabrication
adoption of	new technologies
computer	video
real-time	tendons
collaboration among	competition
Steel	designs
International	escalation

Write down the word combinations into the box

Activity 2: Read the text given below

The words innovation and technology are considered by many as «not applicable» to the construction industry. Yet when defined in simple terms, they very much apply to every construction company. A new technology is a product or process that a company has not previously used in its operation. Innovation is seeking, recognizing, and implementing a new technology to improve the functions a company is performing.

In recent years, technological innovation in design, materials and construction methods have resulted in significant changes in construction costs. Computer-aids have improved capabilities for generating quality designs as well as reducing the time required to produce alternative designs. New materials not only have enhanced the quality of construction but also have shortened the time for shop fabrication and field erection. Construction methods have gone through various stages of mechanization and automation, including the latest development of construction robotics.

The most dramatic new technology applied to construction has been the Internet. The Internet is widely used as a means to foster collaboration among professionals on a project, to communicate for bids and results, and to procure necessary goods and services. Real time video from specific construction sites is widely used to illustrate construction progress to interested parties. The result has been more effective collaboration, communication and procurement.

The effects of many new technologies on construction costs have been mixed because of the high development costs for new technologies. However, it is unmistakable that design professionals and construction contractors who have not adapted to changing technologies have been forced out of the mainstream of design and construction activities. Ultimately, construction quality and cost can be improved with the adoption of new technologies which are proved to be efficient from both the viewpoints of performance and economy.

New Construction Technology Quake-Proofs Buildings. A new method of construction that uses steel tendons and replaceable «fuses» to help a building survive

strong earthquakes was successfully tested recently. The massive force of earthquakes often leave behind damaged buildings that are either beyond repair or very costly to fix.

«Most buildings that we design today for large earthquakes are designed such that when there is a large earthquake, the building, in a sense, sacrifices itself to save the occupants», said Greg Deierlein, a professor of civil and environmental engineering at Stanford University who led the research team.

To reduce structural damage, the new system relies on steel braced-frames, built into a building's exterior walls, which are designed to rock up and down whenever an earthquake strikes. Running down the middle of the frames are steel tendons that are elastic enough to control the rocking. The tendons also help lift the building back to its proper alignment once the shaking stops.

«What is unique about these frames is that, unlike conventional systems, they actually rock off their foundation under large earthquakes», Deierlein said. Steel «fuses» that sit at the bottom of the frame also keep the rest of the building from sustaining damage. The fuses are built to flex and dissipate the seismic energy, which confine the damage to certain areas. Like electrical fuses, the steel fuses are easily replaced when they «blow out». «The idea of this structural system is that we concentrate the damage in replaceable fuses», Deierlein said. While various researchers have been working for 10 or 15 years on some of the ideas and techniques incorporated in the new system, this is the first time anyone has put them all together and demonstrated their performance, Deierlein said. The system can be installed as part of a building's initial design or retrofitted into an existing building. It is also economically feasible to implement since it can be built from materials commonly used in construction, researchers say.

Labour Productivity. The term productivity is generally defined as a ratio of the production output volume to the input volume of resources. Since both output and input can be quantified in a number of ways, there is no single measure of productivity that is universally applicable, particularly in the construction industry where the products are often unique and there is no standard for specifying the levels

for aggregation of data. However, since labour constitutes a large part of the cost of construction, labour productivity in terms of output volume per person-hour is a useful measure.

Actually, over the years, labour productivity has increased in some traditional types of construction. However, labour productivity has been stagnant or even declined in unconventional or large-scale projects.

International Competition. A final trend which deserves note is the increasing level of international competition in the construction industry. Owners are likely to find non-traditional firms bidding for construction work, particularly on large projects. Separate bids from numerous European, North American, and Asian construction firms are not unusual. In the United States, overseas firms are becoming increasingly visible and important. In this environment of heightened competition, good project management and improved productivity are more and more important.

A bidding competition for a major new offshore drilling platform illustrates the competitive environment in construction.

Contractor Financed Projects. Some owners look to contractors or joint ventures as a resource to design, to build and to finance a constructed facility. For example, a utility company may seek a consortium consisting of a design/construct firm and a financial investment firm to assume total liability during construction and thereby eliminate the risks of cost escalation to ratepayers, stockholders and the management. On the other hand, a local sanitation district may seek such a consortium to provide private ownership for a proposed new sewage treatment plant. The activities of joint ventures among design, construction and investment firms are sometimes referred to as financial engineering.

This type of joint venture has become more important in the international construction market where aggressive contractors often win contracts by offering a more attractive financing package rather than superior technology. With a deepening shadow of international debts in recent years, many developing countries are not in a position to undertake any new project without contractor-backed financing. Thus, the

contractors or joint ventures in overseas projects are forced into very risky positions if they intend to stay in the competition.

Activity 2: Answer the question to the text

1. Why are the words «innovation» and «technology» considered not applicable to the construction industry?
2. What is a new technology in the context of a construction company?
3. What is innovation in the construction industry?
4. What are the effects of technological innovation on construction costs?
5. What benefits do computer-aided designs bring to the construction industry?
6. What is the most dramatic new technology applied to construction?
7. How is the Internet used in the construction industry?
8. How have construction contractors who have not adapted to changing technologies been affected?
9. What is the new method of construction that quake-proofs buildings?
10. Why is labor productivity in terms of output volume per person-hour a useful measure?

Activity 3: Write an abstract to the text and retell it

Activity 4: *Resume the text in a few sentences starting with*

This text is about ……

The main attention is given to ……

It can be interesting for …….

14.1 Grammar focus

Step 1: Revision of the rules

Conditionals

Conditional statements are statements that depend on certain conditions to be true. There are four types of conditionals that we use in English (tab.14.1)

Table 14.1 – Conditional Types

Zero Conditional	
This type of conditional is used to talk about something that is **always true**. It is formed with «if» + present simple, present simple	Example: If it rains, the ground gets wet
First Conditional	
This type of conditional is used to talk about something that is **likely** to happen **in the future**. It is formed with «if» + present simple, will + base form of the verb.	Example: If I study hard, I will pass the exam
Second Conditional	
This type of conditional is used to talk about something that is **unlikely** to happen **in the present or future**. It is formed with «if» + past simple, would + base form of the verb	Example: If I won the lottery, I would buy a big house
Third Conditional	
This type of conditional is used to talk about something that **did not happen in the past**. It is formed with «if» + past perfect, would have + past participle	Example: If I had studied harder, I would have passed the exam

Step 2

a) Put the verb into the correct form and explain the rule from the box (Step 1)

1. If a consortium consisting of a design/construct firm and a financial investment firm assumes total liability during construction, it_____ (eliminate) the risks of cost escalation.

2. If we_____ (not develop) earthquake-proof construction methods, many buildings would have been destroyed in recent disasters.

3. If we _____(not embrace) new construction technologies, we will continue to face issues with quality and efficiency.

4. A company _____reduce construction time if it uses computer-aided design.

6. If we don't invest in research and development for construction technology, we _____fall behind other industries.

7. If we _____ (invest) more in research and development, we would have made greater strides in construction technology.

в) Write a sentence with *if* for each situation

1. Many people can't afford new homes because construction costs continue to rise.

If construction costs continue to rise, many people won't be able to afford new homes.

2. We didn't mechanize and automate construction methods, so we couldn't keep up with demand for new buildings.

_____

3. A company collaborates with professionals using the Internet, so it fosters effective collaboration and communication.

_____

4. We ignored the potential of the Internet in construction, so didn't see the benefits it provides for collaboration and communication.

_____

Glossary

Abbreviations: adj. = adjective – прикметник; adv. = adverb – прислівник; pl. = множина; pp. = дієприкметник; n. = іменник; v. = дієслово

to enhance *(v)*	поліпшувати, збільшувати, підвищувати
to foster*(v)*	сприяти, підтримувати, розвивати
bid *(n)*	пропозиція
to procure necessary goods and services	закуповувати необхідні товари та послуги
to force out of the mainstream	витісняти з основного потоку
steel braced-frame	сталева зміцнена рама
to dissipate *(v)*	розсіювати
to retrofit *(v)*	модернізувати, вдосконалювати
unconventional	незвичайний, нестандартний
heightened competition	підвищена конкуренція
to eliminate the risks	усунути ризики
field erection	монтаж на майданчику
joint venture	спільне підприємство
contractor-backed financing	фінансування, яке забезпечується підрядником
debt *(n)*	борг
bidding competition	конкурс на кращу пропозицію
structural damage	пошкодження конструкцій
quake-proof *(adj)*	землетрусостійкий
shop fabrication	виготовлення на заводі
international competition	міжнародна конкуренція
computer-aided design	комп’ютерне проєктування
real time video	відео у реальному часі
fuse *(n)*	плавкий замінник

UNIT 15

Construction Equipment for Different Purposes

Activity 1: Match A and B to make the word combinations

A	B
construction	handling
earth	moving
construction	mounting
material	attachment
compaction	materials
site	trimmers
crawler	scrapers
front-end	graders
earth moving	blade
loader	loader
push-pull	equipment
motor	managers
grade	projects
percussion	vehicles
bituminous	drills

Write down the word combinations into the box

Activity 2: Read the text given below

Various equipment is used for construction projects, which can be categorized into 4 sections: earth moving, construction vehicles, material handling, and compaction equipment. These are used for various operations such as excavation, placement of construction materials, and compaction. Choosing the right equipment affects productivity, making it important for site managers to be familiar with commonly used equipment types.

Construction Equipment for Excavation and Loading. One family of construction machines used for excavation is broadly classified as a crane-shovel. The crane-shovel consists of three major components:

1. A carrier or mounting which provides mobility and stability for the machine.
2. A revolving deck or turntable which contains the power and control units.
3. A front-end attachment which serves the special functions in an operation.

The type of mounting for all machines is referred to as crawler mounting, which is particularly suitable for crawling over relatively rugged surfaces at a job site. Other types of mounting include truck mounting and wheel mounting which provide greater mobility between job sites, but require better surfaces for their operation. The revolving deck includes a cab to house the person operating the mounting and/or the revolving deck. The types of front end attachments might include a crane with hook, claim shell, dragline, backhoe, shovel and piled river.

A tractor consists of a crawler mounting and a non-revolving cab. When an earth moving blade is attached to the front end of a tractor, the assembly is called a bulldozer. When a bucket is attached to its front end, the assembly is known as a loader or bucket loader. There are different types of loaders designed to handle most efficiently materials of different weights and moisture contents.

Scrapers are multiple-units of tractor-truck and blade-bucket assemblies with various combinations to facilitate the loading and hauling of earthwork. Major types of scrapers include single engine two-axle or three-axle scrapers, twin-engine all-wheel-drive scrapers, elevating scrapers, and push-pull scrapers. Each type has

different characteristics of rolling resistance, maneuverability stability, and speed in operation.

Construction Equipment for Compaction and Grading. The function of compaction equipment is to produce higher density in soil mechanically. The basic forces used in compaction are static weight, kneading, impact and vibration. The degree of compaction that may be achieved depends on the properties of soil, its moisture content, the thickness of the soil layer for compaction and the method of compaction. The function of grading equipment is to bring the earthwork to the desired shape and elevation. Major types of grading equipment include motor graders and grade trimmers. The former is an all-purpose machine for grading and surface finishing, while the latter is used for heavy construction because of its higher operating speed.

Construction Equipment for Drilling and Blasting. Rock excavation is a challenging task that requires specialized equipment and methods, with the level of difficulty depending on the physical characteristics of the rock, such as grain size, brittleness, and hardness. The process of rock excavation includes loosening, loading, hauling, and compacting. Loosening is typically achieved through drilling, blasting, or ripping. There are three main types of drilling equipment: percussion drills, rotary drills, and rotary-percussion drills. Percussion drills penetrate and cut rock by impact while rotating, while rotary drills cut by turning a bit against the rock surface. Rotary-percussion drills combine both movements for faster penetration. Blasting is achieved using explosives, typically dynamite, with electric blasting caps connected in a circuit with insulated wires. Tunnel machines with multiple cutter heads are increasingly replacing traditional drilling and blasting methods in rock tunnelling.

Construction Equipment for Lifting and Erecting. Derricks are commonly used to lift equipment of materials in industrial or building construction. A derrick consists of a vertical mast and an inclined boom sprouting from the foot of the mast. The mast is held in position by guys or stiff legs connected to a base while a topping lift links the top of the mast and the top of the inclined boom. A hook in the road line hanging from the top of the inclined boom is used to lift loads. Guy derricks may

easily be moved from one floor to the next in a building under construction while stiff leg derricks may be mounted on tracks for movement within a work area.

Tower cranes are used to lift loads to great heights and to facilitate the erection of steel building frames. Horizon boom type tower cranes are most common in high rise building construction. Inclined boom type tower cranes are also used for erecting steel structures.

Construction Equipment for Mixing and Paving. Basic types of equipment for paving include machines for dispensing concrete and bituminous materials for pavement surfaces. Concrete mixers may also be used to mix Portland cement, sand, gravel and water in batches for other types of construction other than paving.

A truck mixer refers to a concrete mixer mounted on a truck which is capable of transporting ready mixed concrete from a central batch plant to construction sites. A paving mixer is a self-propelled concrete mixer equipped with a boom and a bucket to place concrete at any desired point within a roadway. It can be used as a stationary mixer or used to supply slip form pavers that are capable of spreading, consolidating and finishing a concrete slab without the use of forms.

A bituminous distributor is a truck-mounted plant for generating liquid bituminous materials and applying them to road surfaces through a spray bar connected to the end of the truck. Bituminous materials include both asphalt and tar which have similar properties except that tar is not soluble in petroleum products. While asphalt is most frequently used for road surfacing, tar is used when the pavement is likely to be heavily exposed to petroleum spills.

Construction Tools and Other Equipment. Air compressors and pumps are widely used as the power sources for construction tools and equipment. Common pneumatic construction tools include drills, hammers, grinders, saws, wrenches, staple guns, sandblasting guns, and concrete vibrators. Pumps are used to supply water or to dewater at construction sites and to provide water jets for some types of construction.

Activity 2: Answer the question to the text

1. What are the four sections that construction equipment can be categorized into?
2. Why is choosing the right equipment important for site managers?
3. What are the three major components of a crane-shovel?
4. What is crawler mounting, and what types of machines is it suitable for?
5. What are the basic forces used in compaction, and what is the purpose of grading equipment?
6. What are the three main types of drilling equipment? How do they work?
7. What is the purpose of derricks, and what are the two types of derricks?
8. What is the purpose of tower cranes, and what are the two types of tower cranes?
9. What is a bituminous distributor, and what types of materials can it apply to road surfaces?
10. What is a paving mixer, and what is it used for?

Activity 3: Write an abstract to the text and retell it

Activity 4: *Resume the text in a few sentences starting with*

This text is about ……

The main attention is given to ……

It can be interesting for …….

15.1 Grammar focus

Step 1: Revision of the rules

Relative Clauses

Relative clauses provide additional information about the noun or pronoun they modify, and they can be essential or non-essential to the meaning of the sentence. They usually start with words like «who», «which» or «that».

Table 15.1 – Relative Clauses

Essential relative clauses are necessary to the meaning of the sentence and **cannot be removed without changing the intended message**	Example: The woman *who lives next door* is a doctor
Non-essential relative clauses, on the other hand, provide additional information but **can be removed without affecting the meaning of the sentence.** Non-essential relative clauses are usually set off by commas	Example: My car, *which is a red convertible*, is parked outside
– The relative clause comes right after the noun it's describing. – «Who» is used for people – «Which» is used for things. – «That» is used for either people or things	

Step 2

a) Fill in the blanks with the correct relative pronoun

1. _____ is particularly suitable for crawling over relatively rugged surfaces at a job site.

2. A tractor consists of a crawler mounting and a non-revolving cab, _____ is called a bulldozer when an earth moving blade is attached to the front end of a tractor.

3. Scrapers are multiple-units of tractor-truck and blade-bucket assemblies with various combinations to facilitate the loading and hauling of earthwork, _____ has different characteristics of rolling resistance, maneuverability stability, and speed in operation.

4. The function of grading equipment is to bring the earthwork to the desired shape and elevation, _____ is used for heavy construction because of its higher operating speed.

в) Combine the two sentences using a relative pronoun «who», «which» or «that». Write down them into the table

a. Choosing the right equipment affects productivity, making it important for site managers to be familiar with commonly used equipment types. b. Various equipment is used for construction projects, which can be categorized into 4 sections: earth moving, construction vehicles, material handling, and compaction equipment.	
a. The types of front end attachments might include a crane with hook, claim shell, dragline, backhoe, shovel and piled river. b. One family of construction machines used for excavation is broadly classified as a crane-shovel.	
a. A truck mixer refers to a concrete mixer mounted on a truck which is capable of transporting ready mixed concrete from a central batch plant to construction sites. b. Basic types of equipment for paving include machines for dispensing concrete and bituminous materials for pavement surfaces.	

Glossary

Abbreviations: adj. = adjective – прикметник; adv. = adverb – прислівник; pl. = множина; pp. = дієприкметник; n. = іменник; v. = дієслово

earth moving equipment	землерийна техніка
construction vehicles	будівельна техніка
material handling equipment	обладнання для переміщення матеріалів
compaction equipment	техніка для ущільнення
carrier or mounting	шасі або кріплення
revolving deck	обертова платформа
front-end attachment	приладдя для спеціальних функцій
crawler mounting	гусенична установка
truck mounting	установлення на автомобіль
wheel mounting	установлення на колеса
dragline	візок з ковшем
backhoe	навантажувач-екскаватор
piledriver	погруддя / бюст
scraper	скрепер
kneading	вимішування
grading equipment	сортувальне обладнання
motor grader	автогрейдер
grade trimmer	рейковий розгладжувач
drilling equipment	бурове / вибухове обладнання
blasting equipment	обладнання для підриву
brittleness	крихкість
percussion drills	ударно-бурове обладнання
rotary drills	роторно-бурове обладнання
rotary-percussion drills	роторно-ударно-бурове обладнання
electric blasting caps	електричні запальники
derrick	стріла-підіймач
inclined boom	нахилена стріла
guys	кріплення
paving	укладання дорожнього покриття
truck mixer	бетонозмішувач на автомобілі
central batch plant	центральний завод із виробництва бетону
self-propelled	самохідний
boom	висувний кран
slip form pavers	бруківка з формою ковзання
bituminous distributor	автомобіль-розпилювач бітумних матеріалів
spray bar	розпилювальний брусок
tar	смола

UNIT 16

Tower Cranes

Activity 1: Match A and B to make the word combinations

A	B
mechanical	jibs
transport	wood
loading and unloading	motors
assembling	lifting
powered	freight
harbour	industry
made of	by men
Industrial	iron
cast	systems
internal combustion	engines
electric	heavy equipment
hydraulic	cranes
specific	revolution
jib	oil rigs
build	cranes
luffing	use

Write down the word combinations into the box

Activity 2: Read the text given below

Cranes are mechanical lifting devices equipped with a winder, wire ropes, and sheaves that can lift and move materials horizontally. They are commonly used in the transport industry for loading and unloading freight, in construction for moving materials, and in manufacturing for assembling heavy equipment. The first cranes were powered by men or beasts-of-burden and used for the construction of tall buildings. Harbour cranes were later introduced to load and unload ships in the High Middle Ages. The earliest cranes were made of wood, but with the Industrial Revolution, cast iron and steel became the primary materials used.

Modern cranes usually use internal combustion engines or electric motors and hydraulic systems to provide greater lifting capability than was previously possible. There are many different types of cranes, each tailored to a specific use. Sizes range from small jib cranes to the tallest tower cranes used for constructing high-rise buildings and the largest floating cranes used to build oil rigs and salvage sunken ships.

In 1949, Hans Liebherr's innovation led to the development of tower cranes that could not only swing materials horizontally but also be transported in parts and fully assembled at the construction site. This invention was timely for the construction boom of the 1950-s when buildings were needed quickly and cranes and other equipment were in high demand.

The jib was later modified to luffing jibs, which kept the material level to the base while lifting, and self-climbing mechanisms allowed cranes to grow along with the building. In addition, the job radius of the jib increased. The ease in transportation and assembly, as well as the increasing efficiency, contributed to the development of taller building structures.

Mechanical principles. There are two major considerations that are taken into account in the design of cranes. The first is that the crane must be able to lift a load of a specified weight and the second is that the crane must remain stable and not topple over when the load is lifted and moved to another location.

Lifting capacity. Cranes use simple machines to create mechanical advantage for lifting heavy loads. A balance crane utilizes the principle of the lever with a horizontal beam pivoted about a fulcrum. The load's weight to the applied force ratio is called mechanical advantage. Jib cranes contain a fixed pulley block on a tilted strut. Cables are wrapped around the blocks and attached to the load. When the cable is pulled, the pulley system multiplies the applied force by the number of cable lengths between the blocks to lift the load, resulting in mechanical advantage. The hydraulic cylinder can be used directly to lift the load or indirectly to move the jib or beam that carries another lifting device.

Tower cranes are a familiar sight on most construction projects. They are usually assembled and erected on-site with a horizontal or luffing jib. The tower crane usually has the following parts:

1. **Base**: This forms the base of the tower crane and it is very important component as it forms the interface between the tall steel structure and the concrete building top. It can be compared to the spine supporting a human body. The steel structure of the tower crane is bolted to the concrete pad.

2. **The Mast or the Tower**: The base is connected to the mast or the tower, which gives the height to the crane. This mast or the tower has guard rails and guide rails which guides the elevator. This elevator facilitates the operator and the maintenance technician to reach the operator's cab and the machinery arm from the base.

3. **The Slewing Unit**: This is the mobile unit of the tower crane, which is capable of rotating almost 360 degrees. The rotation of the crane around its own axis is called slewing. It is a set of combination of huge gears and motors which enables the crane to slew.

On top of the slewing unit, the tower crane has three more parts:

1. **Long horizontal jib**: We know that the jib is one of the most important parts of a crane and in a tower crane it extends horizontally carrying a trolley which runs in and out of the crane's center carrying the load. So it can be called as the «working arm» of the crane.

2. **The machine house**: It is also located horizontally along the line of the jib, usually extending behind the crane's center. It houses the crane's motor and other electronic components which are necessary for the operation of the crane. It also incorporates all safety devices for the safe operation of the crane. It is designed to eliminate water ingress and withstand heavy winds. These also incorporate huge concrete counterweights. The main purpose of these counterweights is to provide balance while lifting a load on the other side of the crane through the jib.

3. **Operator's cabin**: The operator's cabin is comfortably located in such a way that none of the crane operation would hinder his visibility. The cabin is provided with almost all facilities which are required and sometimes even comforts are provided. Tower crane operators are capable of seeing most of the lifting operations from the cab, although a banksman is required at ground level both for overseeing the loading of the crane and for issuing signals and guidance to the operator.

How are tower cranes built? Tower cranes are erected by setting a mast section into a foundation with steel pedestals and plumbing it to a degree of 1 : 500. Concrete is poured and allowed to cure before the crane is erected. The 40' tower crane base is set with 16 bolts and torqued to 4300 ft lbs. Mast sections are added until the required height is achieved. The turntable, including the operator cabin, is added in the same way, and is often the heaviest part of the crane. The Tower Top is then added, and four large pins connect the sections. While the bolts on the Mast Section are tightened, the jibs are assembled. The Counter Jib is erected in one piece, connected by gates or pins to the turntable, then elevated by a mobile crane to 15 degrees above horizontal. Pendants are connected by pins with cotter pins, and the Counter Jib is lowered to horizontal. The Working Jib is installed at the turntable and elevated with the mobile crane. After it is elevated, the Tower Crane hoist is connected to the pendant attached to the jib and pulled up to the Tower Top and connected with a pin.

The trolley is installed if not on the ground, followed by the Outer Section of the Jib with three pins. Finally, up to 60 000 lbs of ballast is installed on the Counter

Jib to complete the structural erection of the tower crane. The ropes must then be installed, which can take up to three hours depending on the crane's size and design. The Load Line that hoists the rope is installed after the trolley lines, and runs from the back of the crane, through the tower top and out under the jib to the outer tip of the crane, pinned in place with a thimble or wedge and socket.

Activity 2: Answer the question to the text

1. What are cranes?
2. What are the common uses of cranes?
3. What were the first cranes made of?
4. What materials were used in the Industrial Revolution to make cranes?
5. Who invented tower cranes that could be transported in parts and fully assembled at the construction site?
6. How do cranes create mechanical advantage for lifting heavy loads?
7. What are the parts of a tower crane?
8. How are tower cranes built?
9. What is the purpose of the machine house in a tower crane?
10. What is the purpose of the counterweights in a tower crane?

Activity 3: Write an abstract to the text and retell it

Activity 4: Resume the text in a few sentences

This text is about ……

The main attention is given to ……

It can be interesting for …….

16.1 Grammar focus

Step 1: Revision of the rules

Participles

Table 16.1 – Present Participle, Past Participle

The **Present Participle** is the ing-form	
Present participles are used: – to describe actions that are happening now or at the same time as the sentence (Present Continuous Tense); – as an adjective form; – as a gerund	Example: The dog is barking loudly. The film is interesting. He is afraid of flying
Past Participle. For irregular participle forms see third column of *irregular verbs*. *Regular verbs* form the past participle by adding-ed	
Past participles are used: – to describe actions that happened in the past (Present Perfect Simple); – in Passive Voice; – as an adjective form	Example: I have spoken. (irregular verb *to speak*). The letter was written. (irregular verb *to write*). I was bored to death. (regular verb *to bore)*

Step 2

a) Find the Present Participle in the following sentences and explain its form

1. Cranes are mechanical lifting devices equipped with a winder, wire ropes, and sheaves that can lift and move materials horizontally.

2. They are commonly used in the transport industry for loading and unloading freight, in construction for moving materials, and in manufacturing for assembling heavy equipment.

3. Modern cranes usually use internal combustion engines or electric motors and hydraulic systems to provide greater lifting capability than was previously possible.

4. The jib was later modified to luffing jibs, which kept the material level to the base while lifting, and self-climbing mechanisms allowed cranes to grow along with the building.

5. Increasing efficiency contributed to the development of taller building structures.

6. The tower crane usually has the following parts.

7. The base is connected to the mast or the tower, which gives the height to the crane.

8. The Slewing Unit is the mobile unit of the tower crane, which is capable of rotating almost 360 degrees.

9. Long horizontal jib extends horizontally carrying a trolley which runs in and out of the crane's center carrying the load.

10. Tower cranes are erected by setting a mast section into a foundation with steel pedestals and plumbing it to a degree of 1 : 500.

в) Complete each sentence with the correct form of the verb in brackets

1. Since the Industrial Revolution, cast iron and steel _____(become) the primary materials used in the construction of cranes.

2. The first cranes ___ (power) by men or beasts-of-burden and ___ (use) for the construction of tall buildings.

3. The transport industry _____(use) cranes equipped with winder, wire ropes, and sheaves to load and unload freight, and they _____(become) more efficient with the use of internal combustion engines and hydraulic systems.

4. Harbour cranes ___ (introduce) to load and unload ships in the High Middle Ages.

Glossary

Abbreviations: adj. = adjective – прикметник; adv. = adverb – прислівник; pl. = множина; pp. = дієприкметник; n. = іменник; v. = дієслово

lifting device	підіймальний пристрій
winder	лебідка
wire ropes	сталеві мотузки
sheaves	шківи
loading	навантаження
unloading	розвантаження
freight	вантажі
heavy equipment	важке обладнання
beasts-of-burden	в'ючні тварини
harbour cranes	портові крани
cast iron	чавун
internal combustion engines	двигуни внутрішнього згоряння
hydraulic systems	гідравлічні системи
lifting capability	підіймальна здатність
tailored to	спеціально розроблені під
small jib cranes	малий кран-стріла
floating cranes	плавкі крани
oil rigs	бурові споруди
salvage	підняття затонулих суден
tower cranes	баштові крани
to swing materials	переміщувати матеріали
to transport in parts	транспортувати в розібраному вигляді
construction boom	будівельний бум
luffing jibs	стріли, що розкриваються
self-climbing mechanisms	механізми автоматичного підіймання
job radius	радіус дії
topple over	перевертатися

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