МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
МИКОЛАЇВСЬКИЙ НАЦІОНАЛЬНИЙ АГРАРНИЙ УНІВЕРСИТЕТ

Факультет культури й виховання

Кафедра іноземних мов

АНГЛІЙСЬКА МОВА

методичні рекомендації та навчальний матеріал
для аудиторної та самостійної роботи здобувачів
першого (бакалаврського) рівня вищої освіти усіх ОПП та
спеціальностей МНАУ денної та заочної форм здобуття вищої
освіти

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Зміст

ПЕРЕДМОВА

«**Англійська мова**: методичні рекомендації та навчальний матеріал для аудиторної та самостійної роботи здобувачів першого (бакалаврського) рівня вищої освіти усіх ОПП та спеціальностей МНАУ денної форми здобуття вищої освіти» підготовлені згідно з кредитно-трансферною системою навчання. Дані методичні рекомендації забезпечують навчальний матеріал для вивчення різних модулів першого, другого, третього та четвертого років навчання. Мета даних методичних рекомендацій – активізація лексико-граматичного матеріалу у здобувачів вищої освіти та перевірка їх знань шляхом самостійного виконання різнорівневих тестів та читання соціально-культурних та фахових текстів.

Методичні рекомендації складаються з чотирьох основних частин: I. Лексикограматичні тести, II. Тексти загально-культурної тематики, III. Фахові тексти для спеціальності «Агрономія». IV. Фахові тексти для спеціальності «Геодезія та землеустрій», які надані у даних методичних рекомендаціях можуть бути застосовані з метою перевірки знань лексико-граматичного матеріалу та читання. Кожна частина складається з 10 варіантів. Виконання таких завдань сприятиме закріпленню лексико-граматичного матеріалу з тем, які відповідають типовим програмам з даної дисципліни. Виконання тестових завдань, розроблених за різними граматичними темами, дозволить оцінити знання кожного здобувача вищої освіти. Кожен навчальний текст у даному виданні має два типи завдань: дати відповіді на запитання до тексту та пояснити значення термінів з фаху або сталих стійких словосполучень, поданих у тексті. На кожну тему модуля відводиться 2-8 годин аудиторних занять та 4-10 годин самостійної роботи. За роботу на аудиторних заняттях здобувач може отримати від 10 до 25 балів.

Дане видання допомагає здобувачам поглибити та систематизувати лексичний матеріал, а також набути практичні уміння і навички читання текстів фахової та загальнокультурної тематики. Для підготовки методичних рекомендацій використовувались матеріали із новітніх підручників, автентичних джерел та періодичних видань.

І. ЛЕКСИКОГРАМАТИЧНІ ТЕСТИ

Варіант № 1

ТЕСТ

1) It … again. It… all the time here in winter.
A snows, snows
B snows, is snowing
C is snowing, snows
2) She… I … you.
A understand, likes
B am understanding , is liking
C understands, like
3) What … that girl?
A is
B –
C are
4) What … ?
A do you have
B have you
C you have
5) She's … accountant.
A a
B an
C the
6) Is this bag …?
A yours
B you
C the yours
7) I like … flowers.
A the
B every
C all
8) Ann and Peter phone … every day.
A them
B themselves
C each other
9) it's … story.
A terrible
B a terrible
C the terrible
10) This is … weather for 20 years.
A the more bad
B worse
C the worst
11) I think I …it next year.

A does
B do
C shall do
12) We … a holiday last year.
A did not have
B have not had
C had not have
13) Her eyes … a very dark brown.
A are
B have
C has
14) … help me?
A Can you to
B Do you can
C Can you
15) Mother … her keys, so we have to open the door by force.
A has lost
B lost
C losed
16) …it snowing yet?
A Did it stop
B Is it stopped
C Has it stopped
17) What time did you arrive … my place?
A at
B to
C –
18) Why … my newspaper?
A you are reading
B do you read
C are you reading
19) Where is Tom? He … in the garden.
A is sitting
B sits
C does sit
20) I went out without … money.
A some
B any
C no

Варіант № 2

ТЕСТ

1) It … again. It… all the time here in winter.
A rains, rains
B rains, is raining
C is raining, rains

2) I… she … you.
A think, likes
B am thinking, is liking
C think, is liking
3) Tom and Jane phone … every day.
A them
B themselves
C each other
4) What … ?
A does he need
B does he needs
C he needs
5) Her eyes … a very light blue.
A are
B have
C has
6) The Hills managed to arrive exactly in time because they … a taxi.
A took
B had taken
C taked
7) The sun …, it … dark, and we went home.
A set, got
B had set, got
C had got, set
8) This is … autumn for 10 years.
A the more cold
B colder
C the coldest
9) I think I … you next year.
A visits
B visit
C shall visit
10) Grandfather is in the kitchen. She … tee now.
A is drinking
B drinks
C drink
11) Is this notebook …?
A his
B he
C the his
12) Dad … on Saturdays.
A is usually work
B usually works
C are usually working
13) What … here?

A do you do
B are you doing
C you do
14) My mother … TV now.
A is watching
B watches
C watch
15) She's … university teacher.
A a
B an
C the
16) Is this coat …?
A yours
B you
C the yours
17) I like … small animals.
A the
B every
C all
18) We … supper today.
A did not have
B have not had
C had not have
19) My friend is a writer. He …6 stories.
A has already written
B wrote already
C writed
20) … you like swimming?
A Do
B Does
C Are

Варіант № 3
ТЕСТ

1) There is the man … took your coat.
A which
B who
C that
2) Try … be late.
A not to
B to not
C don't
3) This picture … by a friend of my mother.
A is painting
B was painting
C was painted

4) What … ?
A do you have
B have you
C you have
5) She's … accountant.
A a
B an
C the
6) Is this notebook …?
A his
B he
C the his
7) I like … birds.
A the
B every
C all
8) Tom and Jane phone … every day.
A them
B themselves
C each other
9) it's … story.
A interesting
B an interesting
C the interesting
10) This is … autumn for 10 years.
A the more cold
B colder
C the coldest
11) I think I … you next year.
A visits
B visit
C shall visit
12) We … supper today.
A did not have
B have not had
C had not have
13) Her eyes … a very dark brown.
A are
B have
C has
14) … help me?
A Can you to
B Do you can
C Can you
15) I went to London … clothes.

A for buy
B for to buy
C to buy
16) …it snowing yet?
A Did it stop
B Is it stopped
C Has it stopped
17) What time did you arrive … my place?
A at
B to
C –
18) Why … my book?
A you are reading
B do you read
C are you reading
19) Where is Tom? He … at school.
A is
B are
C be
20) I went out with … friends.
A my
B mine
C me

Варіант № 4

ТЕСТ

1) There is the man … took your coat.
A which
B who
C that
2) Try … be late.
A not to
B to not
C don't
3) Who …the window?
A open
B opened
C did opened
4) I did not … he was at home.
A to think
B think
C thought
5) Is this bag …?
A yours
B you
C the yours

6) I like … flowers.
A the
B every
C all
7) … you like swimming?
A Do
B Does
C Are
8) it’s … weather.
A terrible
B a terrible
C the terrible
9) This is … winter for 20 years.
A the more bad
B worse
C the worst
10) Is this notebook …?
A his
B he
C the his
11) Dad … on Saturdays.
A is usually work
B usually works
C are usually working
12) – Where is Ann? – She …the shops. She will be back late.
A went
B has gone to
C goes
13) Jane and her niece … live in Kiev.
A are not
B does not
C do not
14) …it raining yet?
A Did it stop
B Is it stopped
C Has it stopped
15) This picture … by a friend of my mother.
A is painting
B was painting
C was painted
16) What … ?
A do you have
B have you
C you have
17) She’s … accountant.

A a
B an
C the
18) Why … my newspaper?
A you are reading
B do you read
C are you reading
19) Where is Tom? He … in the garden.
A is sitting
B sits
C does sit
20) I went out without … money.
A some
B any
C no

Варіант № 5

ТЕСТ

1) You … we … you.
A know, like
B am knowing, is liking
C know, are liking
2) What … ?
A does he need
B does he needs
C he needs
3) Grandfather is in the kitchen. She … tee now.
A is drinking
B drinks
C drink
4) We … a holiday last year.
A did not have
B have not had
C had not have
5) Sam … on Mondays.
A is usually working
B usually works
C are usually working
6) – Where is Ann? – She …the shops. She will be back late.
A went
B has gone to
C goes
7) I … glad to see you. How … you?
A is, are
B am, are
C are, is

8) Jane and her niece … live in Kiev.
A are not
B does not
C do not
9) …it raining yet?
A Did it stop
B Is it stopped
C Has it stopped
10) Where is John? He … in the garden.
A is playing
B plays
C does play
11) He … a book at 9 o'clock yesterday.
A was reading
B reads
C read
12) I …early and got out of bed.
A woke up
B had woken up
C waked up
13) The Browns managed to arrive exactly in time because they … a taxi.
A took
B had taken
C taked
14) The sun …, it … dark, and we went home.
A set, got
B had set, got
C had got, set
15) What …? – He is a teacher at our college.
A is he doing
B he does
C does he do
16) I think I …it tomorrow.
A does
B do
C shall do
17) Who …the door?
A open
B opened
C did opened
18) I did not … he was here.
A to think
B think
C thought
19) My friend is a poet. He … 6 poems.

A has already written
B wrote already
C writed
20) … you like reading?
A Do
B Does
C Are

Варіант № 6

ТЕСТ

1) There is the man … took your coat.
A which
B who
C that
2) I… she … you.
A think, likes
B am thinking, is liking
C think, is liking
3) Who …the window?
A open
B opened
C did opened
4) My mother … TV now.
A is watching
B watches
C watch
5) – Where is Kate? – She … London.
A went to
B has gone to
C goes to
6) Grandmother is in the kitchen. She … a cake now.
A is making
B makes
C make
7) Try … be late.
A not to
B to not
C don’t
8) Where is Tom? He … in the garden.
A is sitting
B sits
C does sit
9) We … a holiday last year.
A did not have
B have not had

C had not have
10) This picture … by a friend of my mother.
A is painting
B was painting
C was painted
11) Is this notebook …?
A his
B he
C the his
12) Dad … on Saturdays.
A is usually work
B usually works
C are usually working
13) Why …at my desk?
A you are sitting
B do you sit
C are you sitting
14) I … glad to see you. How … you?
A is, are
B am, are
C are, is
15) My friend is a poet. He … 6 poems.
A has already written
B wrote already
C writed
16) Mag and her sister … live in Rome.
A are not
B does not
C do not
17) I went out without … money.
A some
B any
C no
18) I … a book at 5 o'clock yesterday.
A was reading
B reads
C read
19) I like … birds.
A the
B every
C all
20) I did not … he was here.
A to think
B think
C thought

Варіант № 7

ТЕСТ

1) He … skating.
A likes
B is liking
C are liking
2) it’s … story.
A interesting
B an interesting
C the interesting
3) Her eyes … a very light blue.
A are
B have
C has
4) This picture … by a friend of my mother.
A is painting
B was painting
C was painted
5) What … ?
A do you have
B have you
C you have
6) The Hills managed to arrive exactly in time because they … a taxi.
A took
B had taken
C taked
7) My friend is a writer. He …6 stories.
A has already written
B wrote already
C writed
8) Is this notebook …?
A his
B he
C the his
9) I like … birds.
A the
B every
C all
10) Tom and Jane phone … every day.
A them
B themselves
C each other
11) Where is Tom? He … in the garden.

A is sitting
B sits
C does sit
12) We … a holiday last year.
A did not have
B have not had
C had not have
13) This is … autumn for 10 years.
A the more cold
B colder
C the coldest
14) I think I … you next year.
A visits
B visit
C shall visit
15) We … supper today.
A did not have
B have not had
C had not have
16) Why …at my desk?
A you are sitting
B do you sit
C are you sitting
17) I … glad to see you. How … you?
A is, are
B am, are
C are, is
18) Mag and her sister … live in Rome.
A are not
B does not
C do not
19) …it raining yet?
A Did it stop
B Is it stopped
C Has it stopped
20) I went out without … money.
A some
B any
C no

Варіант № 8
ТЕСТ

1) He … skating.
A likes
B is liking
C are liking

2) What … here?
A do you do
B are you doing
C you do
3) My mother … TV now.
A is watching
B watches
C watch
4) We … our grandparents last year.
A visit
B have visited
C visited
5) Sam … an engineer.
A is
B are
C –
6) – Where is Kate? – She … London.
A went to
B has gone to
C goes to
7) I … glad to see you. How … you?
A is, are
B am, are
C are, is
8) Jane and her friends … speak English.
A do not
B does not
C not
9) …it raining yet?
A Did it stop
B Is it stopped
C Has it stopped
10) Where is Dave? He … in the kitchen.
A is eating
B eats
C does eat
11) He … to the radio at 7 o'clock yesterday.
A was listening
B listens
C listen
12) I …early and had my breakfast.
A woke up
B had woken up
C waked up
13) He managed to arrive exactly in time because he … a bus.

A took
B had taken
C taked
14) The sun …, it … dark, and we went home.
A set, got
B had set, got
C had got, set
15) What …? – He is a doctor.
A is he doing
B he does
C does he do
16) I think I … this book tomorrow.
A reads
B read
C shall read
17) Who …the window?
A close
B closed
C did closed
18) I did not … her.
A to know
B know
C knew
19) My friend is a poet. He … 6 poems.
A has already written
B wrote already
C writed
20) … she like playing chess?
A Do
B Does
C Are

Варіант № 9

ТЕСТ

1) It … again. It… all the time here in winter.
A rains, rains
B rains, is raining
C is raining, rains
2) I… she … you.
A think, likes
B am thinking, is liking
C think, is liking
3) Who …the window?
A open
B opened
C did opened

4) What … ?
A does she want
B does she wants
C she wants
5) I did not … he was at home.
A to think
B think
C thought
6) I … glad to see you. How … you?
A is, are
B am, are
C are, is
7) Mag and her sister … live in Rome.
A are not
B does not
C do not
8) … you like swimming?
A Do
B Does
C Are
9) Grandmother is in the kitchen. She … a cake now.
A is making
B makes
C make
10) Dad … on Saturdays.
A is usually
B usually works
C are usually working
11) I think I …it tomorrow.
A does
B do
C shall do
12) We … a holiday last year.
A did not have
B have not had
C had not have
13) – Where is Jane? – She …the shops. She will be back soon.
A went
B has gone to
C goes
14) My friend is a writer. He …6 stories.
A has already written
B wrote already
C writed
15) Mother … her car keys, so we have to open the door by force.

A has lost
B lost
C losed
16) …it raining yet?
A Did it stop
B Is it stopped
C Has it stopped
17) What …? –She is a secretary at our college.
A is she doing
B she does
C does she do
18) Why …at my desk?
A you are sitting
B do you sit
C are you sitting
19) Where is John? He … in the garden.
A is working
B works
C does work
20) … your brother … in Moscow?
A Is…live
B Does…live
C Does…lives

Варіант № 10

ТЕСТ

1) You … we … you.
A know, like
B am knowing, is liking
C know, are liking
2) I went out without … money.
A some
B any
C no
3) Why … my newspaper?
A you are reading
B do you read
C are you reading
4) …it raining yet?
A Did it stop
B Is it stopped
C Has it stopped
5) … you like swimming?
A Do
B Does
C Are

6) Grandmother is in the kitchen. She … a cake now.
A is making
B makes
C make
7) Try … be late.
A not to
B to not
C don't
8) This picture … by a friend of my mother.
A is painting
B was painting
C was painted
9) What … ?
A do you have
B have you
C you have
10) She's … accountant.
A a
B an
C the
11) Jane and her friends … speak English.
A do not
B does not
C not
12) What time did you arrive … the station?
A at
B to
C –
13) Who …the window?
A open
B opened
C did opened
14) … help me?
A Can you to
B Do you can
C Can you
15) Mother … her keys, so we have to open the door by force.
A has lost
B lost
C losed
16) Tom and Jane phone … every day.
A them
B themselves
C each other
17) it's … story.

A interesting
B an interesting
C the interesting
18) Her eyes … a very light blue.
A are
B have
C has
19) I …early and got out of bed.
A woke up
B had woken up
C waked up
20) The Hills managed to arrive exactly in time because they … a taxi.
A took
B had taken
C taked

II. ТЕКСТИ ЗАГАЛЬНОКУЛЬТУРНОЇ ТЕМАТИКИ

Варіант №1

ACCELERATION

Acceleration is the process of fast growing and physical development of children, if compared to the previous generations. For the first time this phenomenon was observed in the middle of the 19th century. Mainly it is typical for economically developed countries. Acceleration is a topical issue nowadays because any family could sooner or later face this problem. Today in comparison with the previous generations children seem to grow up so quickly. Young people start to dress and look like adults at an early age. They use different sorts of cosmetics: creams, lotions, hairsprays and cologne to look attractive for their peers. They communicate with the opposite sex readily, without uneasiness. Nowadays the young are better educated. They have more money to spend. As they grow up quicker they are not so dependent on their parents. They think more for themselves and don't blindly accept the ideas of their elders.

Варіант №2

LIVING TEACHES MORE THAN SCHOOL, UNIVERSITY DOES

This is a controversial issue whether living teaches us more than school, university and other social institutions. It's really hard to say definitely either "yes" or "no". The kind of knowledge we acquire at school or university differs from what life teaches us, it's just knowledge for different purposes. For example, if one is destined to become a novelist, some exotic interference and general knowledge would sometimes be more useful than a degree. But if one aspires to become a scholar, it's absolutely necessary to put oneself through a university course. Anyway, there have been numerous claims, that school, which supposedly prepares us for after life, is nothing but mental gymnastics. Lots of young people say, that the knowledge acquired there is hardly relevant for the real life, that school-leavers often don't know what career they'd like to pursue, because they have a restricted view of life.

Варіант №3

IMMIGRATION

Immigration has existed during the whole history of humankind. At distant times tribes roamed in search for new pastures for their livestock, new places for hunting and fishery. Later people started to migrate in search for more fertile lands and foundation of new settlements. Today migration still takes place in the world, people are forced to change their places of living due to different natural and man-made calamities. So migration is the process which takes place when an individual or a group live one country for another with the intention to settle permanently down in that country. There are many reasons which make people leave their homes and move to other places. Economic reasons have always been among the main reasons for migration. Life in poverty and despair often forces people to search a better life.

Варіант №4

NEGATIVE CONSEQUENCES OF IMMIGRATION

Immigration has its negative consequences as well. Pretty often immigration causes dissatisfaction of native citizens: it leads to racism, increased antagonism and other social problems. Take for instance the situation with Spanish speaking people in the USA. Many of them do not speak English at all, they are illegal immigrants, so they cannot reckon on social benefits or support from the government. More often they do rough work and receive paltry wages for their backbreaking labour. It seems to me that such people can be called “modern slaves”; because of fear to lose even these low-paid jobs they are ready to work extra hours and receive almost nothing for work. These people live in poverty, they settle in poor districts, where rate of criminality is high and insanitary conditions prevail in the majority of houses, it is often occurs that people from these districts sell or take drugs, become involved into prostitution, etc. As the result native citizens are dissatisfied with afflux of such immigrants, it deepens such social problems as racism, antagonism and chauvinism.

Варіант №5

MORAL VALUES OF SOCIETY YOU LIVE IN

To start with it's necessary to say that human spirit longs for liberation, not just economic or political but also for inner liberation from the down-drag of base instincts: hate, bitterness, greed and lust which all too easily enslave us. People long to be themselves, to have a sense of worth and purpose in life, to be able to contribute their time and talent to something worthy. It requires recognition that we are first and foremost spiritual beings in the age of information overload. Nowadays social values are deeply changed in comparison with those our parents possessed. Our motives are hardly guided today by moral standards of honesty, purity, selflessness and love for others. If we compare present values of the pluralistic society with Victorian ones, we can clearly notice that in those times much attention was paid to self-reliance and self-respect. People worked hard to improve themselves, they lived within their income, they gave a hand to each their neighbors and were good members of their community.

Варіант №6

GLOBALIZATION

"Globalization" is the sort of word where everyone is expected to know what it means, but where few people could offer a clear definition. Globalization is a controversial issue for business and governments throughout the world. We recognize globalization mainly through its effects. It's a bit like electricity - we can not see it, but we certainly observe what it does. Globalization can be described as a process by which the people of the world are unified into a single society and function together. This process is a combination of economic, technological, sociocultural and political forces. It's a movement of people, goods, capital and ideas due to increased economic integration. Globalization is a controversial issue mainly because different groups interpret it in different ways. For its opponents globalization is a threatening word. It prompts visions of large multinationals dominating the world in pursuit of ever-higher profits.

Варіант №7

ENVIRONMENTAL PROTECTION

Many centuries ago people lived in harmony with nature because industry was not much developed. There was no ecological problem until people built lots of plants and factories which sent wastes into the air, water and land where they didn't disappear but lasted forever in one form or another. Nowadays people live only according to their wants and requirements, they ignore the laws of nature. That's why today the contradictions between man and nature are dramatic. People are slowly destroying the nature environment around them. Today we are anxious about the state of the air we breathe because every year world industry throws out into atmosphere about 1 000 million tons of dust, smoke and other harmful substances and people of many cities suffer from smog. Another reason why there is such high level of air pollution in large cities is because of car exhaust fumes from very intensive transport.

Варіант №8

MONEY

Money is medium of exchange. Many centuries ago when money didn't exist people used barter - people exchanged some goods they had for goods they didn't have. Later commodity money appeared: at first fur and salt served as money, then people started to use precious metals to pay for different goods. The first paper money appeared in China in 1024. Today it is widely used across the world. For what purposes do people use money at present? First of all it is still a medium of exchange; when people want to buy something they need to pay for it a certain amount of money (they can pay for goods or services in cash, with the help of cashless transfers or electronic money). Money is also used as a unit of account - money determines cost of all goods and services. Owing to money each person can interpret prices, costs, profits and debts; in such a way people have an opportunity to monitor their financial situations, plan their expenses and measure their future profitability.

Варіант №9

WEATHER CHANGES

According to the dictionary weather is the general condition of the atmosphere at a particular time and place, with regard to the temperature, moisture, cloudiness, etc. Air, fire, earth and water are the elements of the weather according to the ancient Greek philosophers... Substitute the Sun for fire and we have the essential components of the weather machine. Without air warmth and water the Earth couldn't support life, but without any single one of those elements weather wouldn't exist. The air is the medium in which all weather happens, heat from the Sun provides the energy that drives the weather machine, and water provides much of the variety of our day-to-day weather. Weather changes according to the seasons. Every season has its specific features of the weather, which are different. In general a season is one of the four periods of the year. Each season lasts about three months and brings changes in temperature, weather, and the length of daylight.

Варіант №10

THE GREAT AMERICAN INVENTOR THOMAS ALVA EDISON

The great American inventor Thomas Alva Edison was born on 11th of February in Milan, state Ohaio, in 1847. It was often been said that Edison had no schooling. And it is true that he went to school for only 6 month (when he was 7 years old he went to school, but Thomas had to leave it because his teacher thought that he was a stupid boy). But his mother taught him at his boyhood at home in Port Huron, Michigan. With her help, he was reading histories of the Roman Empire at the age of 8 or 9. When Thomas was 12 years he started selling newspapers on Michigan trains, he spent whole days reading in the Detroit Free library (he visited it at first in 1855). In his home he always had books, magazines and half a dozen of daily newspapers. From childhood, this man who was to achieve so much was almost completely deaf. He could hear only the loudest noises, but this didn't trouble him. He believed that it drove him to reading when he was young, provided silence in which he could think, and saved him from small talk.

ІІІ. ФАХОВІ ТЕКСТИ ДЛЯ СПЕЦІАЛЬНОСТІ «АГРОНОМІЯ»

Варіант №1

SOIL

Soil plays a vital and important role in the life of the world and mankind. It is in fact a highly organized physical, chemical and biological complex all of us are dependent on. As the supporter of vegetable life, soil plays the most fundamental of roles in providing food for all animals and men.

Soils develop under the influences of climate, vegetation, slope and drainage, time, the nature of the parent material, and the culture. Climate influences plants, animals and soil directly. Plants influence the soil, the animals and the climate near the ground. Animals play a considerable role in soil development, the type of soil often influences the animals which are present in it, while the animals also influence the vegetation which is growing in the soil. Finally climate, through weathering, influences the rocks, which in time become part of the soil through the processes of soil formation.

All soils do not have the same utility, but man uses different soils in different ways. “Good” land for the production of food-stuffs must lie well and have good depth, for yields are dependent upon the ability of the soil to take up and use fertilizers and water. Man has done much to adapt crops to the soil and to provide various kinds of fertilizers for plant growth and development. Soils that are not good for the production of food-stuffs may be valuable in other ways. For example, podzols in high elevations are poor for crops but they comprise excellent forest soils.

Each soil series requires skilful handling if it is to produce to its maximum potential; but no two series make the same demands. From season to season conditions of temperature and moisture change, so the farmer must change the management to produce better drainage, improve tilth, prevent erosion, and test the soil to identify the proper kind and the correct proportion of fertilizer needed. Only by careful study of the soil, resulting in an understanding of the complexity of its nature and uses, will man be able to provide food for all the people who will inhabit the earth. The soil cannot reproduce itself. Therefore, man should improve it through good management and treatment so that future generations can farm more efficiently than their fathers and grandfathers had done. Man can improve the soil now in use and even discover how more kinds of soils can be utilized more productively.

So, the results obtained in soil science can be applied to practical problems in agriculture, horticulture, forestry, engineering, and in planning the future use of land.

Варіант №2

PHYSICAL PROPERTIES OF SOILS

The physical properties of a soil are a determined largely by its texture, or the size of the particles of which it consists, and its structure, or the arrangement of these particles.

For a soil to be in good physical condition for plant growth, the air, water, and solid particles must be in the right proportions at all times. Every cubic foot of soil that supports plant life must be:

1) well enough aerated to permit all plant root cells to obtain oxygen at all times, but not excessively aerated to the point of preventing a continuous contact of roots with moist soil particles;

2) open enough to permit the right amount of rain-water or irrigation water to enter the soil, but not so open as to allow excessive loss of water and plant nutrients by deep percolation;

3) sufficiently retentive of moisture to supply roots with all needed water, but not so retentive as to create undesirable suspended water-tables.

Soil texture has to do with the fineness or coarseness of soil particles. Mineral particles which make up the bulk of soil vary greatly in size. The four principal size categories are “gravel”, “sand”, “silt”, and “clay”. Some soils, for example sand, consist largely of particles of approximately the same size. Most soils, however, have two or more groups, classified by size of particles, usually with one group dominant. Thus, in grouping soils into texture classes, the proportion of particles belonging to different size groups, as well as the particle sizes themselves, are important.

In most soils texture varies greatly from the surface downward. The subsoil usually contains more clay and other fine material than does the surface soil, although this is not always the case. In soil classification, the texture of the surface soil seems more significant than that of deeper layers. Therefore, soils are usually classified according to the texture of a six- to eight-inch thick surface layer, approximately the “plow layer”. Six major texture groups are “sand”, “sandy loam”, “silt loam”, “loam”, “clay loam”, and “clay”. Each of these groups may be subdivided when it is useful to do so.

Many soil qualities are closely related to texture. Since fine-textured soils have greater pore space and larger surface area than coarse-textured soils, they provide greater storage space for water and better feeding zones for plant roots. Thus, in a broad way, relatively fine-textured soils are more productive agriculturally than are soils with coarse texture. Too fine a texture, however, adversely affects tillage. Sands and sandy loams are more easily tilled than clays and clay loams because the tilling of the former requires less power and is hindered less by wetness.

Варіант №3

CHEMICAL PROPERTIES OF SOILS

Soils vary greatly in their chemical make-up. This variation is due to the chemical composition of the parent materials and to the climate and plant and animal life under which the soil developed.

Soils contain most, if not all, known elements in varying amounts and many forms. Oxygen, silicon, aluminium, and iron are the most abundant. Rarely, if ever, does a soil show a deficiency of any of these four elements. However, many soils are deficient in several other elements that are critical to plant growth. These elements are referred to as “fertilizing elements”, since they are known to be widely used in artificial fertilizers. Nitrogen, phosphorus, and potassium are the three most common. They are constituents of most commercial fertilizers, their proportions usually being 5-10-5 and 6-4-4.

A few elements essential in small amounts to many plants are contained in very small quantities in most soils. These have been referred to as trace elements, because the amounts present in the soil can neither be estimated nor determined very accurately.

Soil conditions range from acidity to alkalinity. Acidity and alkalinity are directly opposite conditions of soil. Neutral soils are neither acid nor alkaline. Soil water becomes acid by absorbing carbon dioxide from the air and by absorbing acid products formed by the decomposition of mineral and organic matter.

In a broad sense, soils in humid climates tend toward acidity, whereas soils in dry climates tend toward alkalinity.

Most plants, particularly most cultivated crops, will not tolerate a high degree of either acidity or alkalinity. Since most agriculture is carried on in relatively humid climates, acidity is a troublesome and costly problem with many soils. Vast amounts of lime are used to neutralize soil acidity.

Chemically, a soil is acid if a water solution contains more acid ions (hydrogen) than basic ions (hydroxyl), and it is alkaline if the water solution contains more hydroxyl ions than hydrogen ions. If a solution contains the same number of hydrogen and hydroxyl ions, it is neutral.

The breaking down of water molecules into ions is known as ionization. As a matter of convenience, the concentration of hydrogen ions is usually expressed symbolically as pH. A pH scale with numbers ranging from 0 to 14 indicates relative concentrations. For example, at pH = 7, the midpoint, there are the same number of hydrogen ions and hydroxyl ions, and the solution is neutral. Any pH values below 7 indicate the presence of more hydrogen ions, or an acid condition; values above 7 denote the presence of more hydroxyl ions, or an alkaline condition.

Варіант №4

FERTILIZATION

In spite of the increasing use of synthetic fertilizers in agricultural practice and the subsequent raise of crop yields, it is found generally that to maintain a high level of inherent fertility their use must be accompanied by periodic applications of bulky organic manure, either in the form of farm manure, compost, or other organic by-product, either of the farm or of certain industries.

The maintenance of high productivity depends on a number of factors; the soil must be in the optimum condition for crop growth and must be in a position to furnish both food and water; it must have a suitable reaction in the chemical sense, and it must contain no substances toxic to growth. It must be physically amenable to cultivation, resistant to forces of erosion, and the micro-flora and micro-fauna must be of a character to ameliorate the general chemical and physical properties of the soil and the soil-plant relationship. Any substance which when added to the soil brings about an improvement in any one of those directions could be considered as a fertilizer or manure using the terms in their widest sense, and it is in connection with these indirect benefits that organic manures are of such great importance in fertilizer practice.

As a source of plant food, farmyard manure contains all the important nutrients although their availability is variable. The potassium present is readily soluble and immediately available; the nitrogen is present in both available forms, and in compounds which only slowly break down; the phosphate compounds also decompose slowly. This is one reason why, for particular crops, applications of manure need to be supplemented with dressings of inorganic fertilizers and in particular with available phosphorus compounds. The less available portions of the farmyard manure are slowly released and become of value to succeeding crops.

Whatever the type of soil, applications of manure can have a beneficial action upon the physical properties. Heavy soils can be made easier to work, and the aeration and drainage improved by means of the increased organic-matter content, whilst on sandy soils the moisture-holding capacity of the manure increases drought resistance, the binding effect of the organic matter controls erosion and the increased base-exchange capacity improves the power of the soil to retain plant nutrients. Soil color will be darkened by the incorporation of humus, with an increase in the heat-absorbing power.

Варіант №5

WHEAT

Wheat-growing was extensively practiced throughout Europe in prehistoric times and this cereal was of great importance in the ancient civilizations of Persia, Greece and Egypt. It spread to all the temperate countries where it now plays a major part in the food supply of many nations and it is also widely cultivated in tropical and subtropical areas.

Cultivation

It is often said that winter wheat does best on a well-formed seed-bed. Plowing should be done as early as possible and the normal depth would be in the region of 6 inches. The type of seed-bed required for winter wheat can be described as one with a reasonable tilth in the top 2-3 inches, with a surface containing a high proportion of clods, the largest of these being about the size of a man's hand. This is to prevent capping, a condition which can easily arise with heavy rain, when the soil surface runs together forming a crust.

Manuring

With all crops it is essential to ensure that adequate supplies of phosphate and potash are available during the first few weeks of growth. Once observed it is not possible to correct properly any deficiency and both of these major elements are required either in advance of drilling or they may be combine-drilled with the seed. Combine-drilling is the most economical way of applying these fertilizers, but with winter wheat time of sowing being of prime importance, the faster method of application using fertilizer sprinners is more often preferred. For average conditions 30 units each of phosphate and potash will be sufficient. If soil is rich in nitrogen, then 30 units/acre of fertilizer nitrogen would suffice, but under average conditions levels up to 60 units are considered economic rising to 80 units in the low rainfall areas. Previous cropping, local environment and to some extent cultural techniques can also influence the optimum level of this nutrient. When the soil is likely to supply some nitrogen for early growth of a winter crop, then it is unlikely that any autumn fertilizer nitrogen would be required.

The short, stiff-strawed varieties of wheat can stand high levels of fertilizer nitrogen whereas the taller ones used to produce quality straw will only tolerate moderate amounts. Of all the cereals winter wheat will give the highest response to this fertilizer and to obtain the best return the proper dressing should be applied at the correct time.

As far as spring wheat is concerned up to 60 units of nitrogen can be economic. It should be applied prior to drilling or combine-drilled with the seed.

Варіант №6

MAIZE

Types of Maize

Several thousand varieties of maize are now grown throughout the world and most of these can be allocated to one of the seven most important groups: dent maize, flint maize, sweet corn, soft maize, popcorn, waxy maize, pod maize.

Soil Requirements

Successful maize cultivation is more frequently and more easily achieved on soils which are of medium texture. As the soils become lighter the greater is the chance of their “drying out” in midsummer and although there is really nothing else against them, the very light sandy soils should be avoided.

Having suggested light to medium textured soils for maize, it must also be stressed that organic status and fertility should be high.

The maize land should be free draining in order that as much of the heat as possible is employed in raising soil temperatures and not removing excess of soil moisture. The soil should be naturally free draining to enable a full rooting system to develop in a plentiful supply of oxygen.

Maximum yields are believed to be obtained between pH 4 and 9. Some scientists believe maize to be successfully cultivated on the moderately acid soils (pH 6-7 as optimal). Others say that maize growing can be successful under alkaline conditions provided there are no serious deficiencies of the micro-nutrients.

Application of Fertilizers

It has been suggested that phosphate and potash should be applied to the land well in advance of drilling and the nitrogen incorporated into the seedbed just prior to drilling, otherwise much of it would be lost by leaching. One should remember that germination is much retarded by fertilizers in contact with the seed.

Maize can be fertilized at three different times. A corrective broadcast application is done before plowing. Soil deficiencies are corrected with large amounts of fertilizers.

A starter fertilizer is applied with the planting equipment. The purpose of this application is to aid a small maize plant to get a more rapid start. It is best to place fertilizer about 1 inch below and 2 inches at the side of the seed.

Cultivation

With a more extensive and deeper rooting system than the other cereals, maize will require deeper plowing, cultivations and seed-beds to obtain maximum growth. Autumn plowing is advisable on stronger soils and it may be left until the early spring when textures are light. Cultivations which follow should be to a depth of 4-5 inches. They kill the weeds after germination; inter-row cultivation can follow crop emergence to obtain further weed control. Chemical means are often preferred. Seed-beds should be uniform and fine to obtain a quick germination and to assist the action of herbicides in their control of weeds.

Seeding

Minimum temperatures for growth of maize are around 50° F (10° C) and thus early spring sowings are of little value except when the soils are warmer than usual. Under cool conditions seeds rot.

When maize follows a good legume crop no additional nitrogen may be required. But when maize follows maize additional nitrogen is usually needed. This may be applied before the crop is planted or between the rows until the crop is 15 to 18 inches tall.

Варіант №7

OATS

Soil

The cultivation of oats may take place on a wide range of soil types with a reasonable degree of success. Oats can be found on all the light to medium soils in the higher rainfall areas and will give high yielding crops of good quality. They can also produce good crops on some of the heavier soils, clay and silts, in the drier areas of Britain where there are significant moisture reserves in the soil which can be drawn upon during a particularly dry time.

It is true that oats will grow well where barley will fail completely and wheat produces only moderate crops but extreme acidity even with oats cannot be tolerated.

Climate

The oat crop is particularly suited to the cooler, more humid climate of the western and northern regions of Britain where growth is relatively slow and as a result the grains have plenty of time to fill out to produce good plump samples.

Oat crops which do not suffer through lack of moisture will produce high grain yields of good quality and on the average the straw will weigh slightly more than the grain. Most of the world's oats are supposed to be produced at elevations below 2,000 feet and probably half below 1,000 feet.

Seed-bed Preparation

Oats are said to be the best cereal to follow the plowing up of grassland but this is only true if the grass is turned in timely and well, the furrow slice being properly inverted and no large air pockets left which tend to accentuate drying out.

Plowing depths should be 6 inches except where grass or surface trash need to be buried deeper and then 8-9 inches plough depths may be required. Where early plowing has been carried out it is often only necessary to give the land a light-medium harrowing to obtain the desired tilth in the cop 3 inches of the soil.

Drilling

Optimum drilling depth with oats lies in the region of 1.5-2 in. When seed-beds have an irregular surface tilth, drilling depth becomes uneven and in order to ensure that all the seed is covered, it will often go in well below the optimum in many areas and this will be responsible for patchy stands.

Drilling in autumn tends to be at slightly lower depths than in spring on account of the rougher soil surface which is purposely left to reduce the dangers of surface capping. Early spring drilling may also go in deeper than normal in an attempt to reduce losses through bird activity.

The two main advantages of combine drilling are firstly, the seed and fertilizer go on in one operation and secondly, it is possible to obtain maximum benefit from the minimum amount of fertilizer, notably the phosphate and potash content. The main disadvantage lies in the fact that the rate of sowing is much reduced and since delays in drilling usually mean lower yields the faster method of seeding using a wide drill following a fertilizer spinner is more often employed for winter seeding.

Варіант №8

BARLEY

1. The first requirement in the production of any crop is to see that soil conditions are as close to the optimum as possible. Barley prefers

well-drained soils, light to medium in texture with a high pH. When fertility is high and weather conditions are favorable high yielding crops of good quality are obtained. When pH values are recorded below 6.0, it would be wise to lime specifically for this crop and it should be worked into the topsoil in advance of sowing. Since the grain yield with barley is likely to be higher than with oats and due to its better feeding value, it has replaced the traditional oat crop on many dairy farms in Britain. As long as the pH is over 6 and the soil is in reasonable conditions, there is no reason why this crop cannot be grown on most soils in Britain, one notable exception being the wet soils associated with upland conditions.

2. When barley is grown in the wetter areas of Britain, it does best when the rainfall is below normal and when sunshine hours are higher than usual.

Low rainfall in April and early May and cool weather in May is required for high yields. High rainfall in the previous winter appeared detrimental and warm dry weather was required during ripening.

3. Winter barley is often sown after early harvested sugar beet on the lighter soils, since seed-beds can often be easily and quickly prepared for sowing in October and November. With large acreage of arable land in cereals, many crops of winter barley will go in after spring cereals, but it would be unwise to grow winter barley following winter barley due to the increased disease risks involved. Spring barley may follow almost any other crop provided the land is not in too high a state of fertility, otherwise wide-spread lodging can result. Under systems of cereal monoculture or close cereal cropping spring barley is the most commonly chosen crop since it appears least affected by disease. Although a yield depression has nearly always been recorded with intensive cereal growing, it has been the least with spring barley and with such a short growing season cultural weed-control, disease control, timely plowing and cultivation can easily be achieved. It will be noted that where adequate mineral fertilizers are returned to the land or via the application of farmyard manure, the yield of barley can easily be maintained and in most cases it is likely to greatly exceed that recorded at the beginning of the experiment. Results from a continuous barley cropping experiment suggested that yields can be maintained by the application of 75-100 units of nitrogen and although pests and diseases are not serious, perennial grass weeds appeared the greatest hazard to a continuous cereal farming system.

Варіант №9

GROWING PLANTS INDOORS
(Part 1)

Plants are made up of different parts. Each part has a certain job. These parts can also help us to identify plants. You can eat certain plant parts. They are important food sources for both humans and other animals. There are seven basic requirements that plants need in order to grow properly: temperature, light, water, air, nutrients, time, and room to grow. Plants can be grown both indoors and outdoors for food, shelter, clothing, medicine, energy, and pleasure.

All plants need these seven things to grow: room to grow, the right temperature, light, water, air, nutrients, and time.

Room to grow

All plants like to have room to grow. The above ground portions of the plant need space so leaves can expand and carry out the job of making food. Roots also need room to grow. Plants growing in small spaces will have their roots crowded, and that results in smaller amounts of growth.

Temperature

Most plants like temperatures that most humans like. Some may like warmer temperatures while others may prefer cooler temperatures for best growth. It is always good to know where plants come from so you can make them feel at home. Most plants like to have cooler temperatures at night and don't like to be in a drafty spot.

Light

Plants grown indoors like bright light. Windows facing the south or west have the best light. Try to place the plants close to the window to take advantage of all the light. The further away from the window, the darker it becomes. A plant will tell you when it isn't getting enough light, because its stems will be thin and it will lean toward the light. If you don't have a bright window, try using grow lights. Remember to have the light about six inches above the plants and leave it on for 14-16 hours each day.

Water

Water is important in the plant's ability to make and move nutrients. Without water or with too much water, a plant dies. For this reason, watering is an important part of plant care. Most plants like to be watered when the soil is slightly dry to the touch. When watering, moisten the soil by using enough water so that it starts to come out of the hole in the bottom of the container. (This is why it is important to use containers with drainage holes.) How often you water depends on a lot of things. Plant size, time of the year, and type of plant are a few. Your best guide, though, is to feel the soil. If you stick your finger one inch into the soil and it is dry, then water your plant.

Air Plants use carbon dioxide in the air and return oxygen. Smoke, gases, and other air pollutants can damage plants.

Nutrients

Most of the nutrients that a plant needs are dissolved in water and then taken up by the plant through its roots. Fertilizers will help to keep the soil supplied with nutrients a plant needs. Don't apply too much too often. Fertilizer won't solve all of your plant problems, so make sure your plants have good light, good soil, and good drainage. The three most important nutrients are nitrogen, phosphorous, and potassium. **Nitrogen** is used for above ground growth. This is what gives plants a dark green color. Phosphorous helps plant cell division. It aids in flower and seed production and in the development of a strong root system. **Potassium** helps fight off disease and provides for strong stems.

Варіант №10

GROWING PLANTS INDOORS (Part 2)

Time

It takes time to grow and care for plants. Some plants require more time to grow than others. Getting plants to flower or fruit at a certain time can be challenging. Plants that normally grow outdoors need a certain number of days to flower or fruit. You can time plants to flower or fruit on a certain date. This is a good lesson in both plant science and math.

Life Cycle

A plant's life cycle describes how long a plant lives or how long it takes to grow, flower, and set seed. Plants can be either an annual, perennial, or biennial.

Annual

A plant that completes its life cycle in one growing season. It will grow, flower, set seed, and die.

Examples: tomatoes, and petunias.

Perennial

A plant that lives for 3 or more years. It can grow, flower, and set seed for many years. Underground parts may regrow new stems as in the case of herbaceous plants, or the stems may live for many years like woody plants (trees).

Examples: Daisies, chrysanthemums, and roses.

Biennial

A plant that needs two growing seasons to complete its life cycle. It grows vegetatively (produces leaves) one season. Then it goes dormant or rests over the winter. In the spring, it will begin to grow again and grow flowers, set seed, and die. The seed that is left behind on the ground germinates and the cycle begins again.

Examples: Parsley, carrots

Plant Parts – Roots

Basic parts of most all plants are roots, stems, leaves, flowers, fruits, and seeds.

The roots help provide support by anchoring the plant and absorbing water and nutrients needed for growth. They can also store sugars and carbohydrates that the plant uses to carry out other functions. Plants can have either a taproot system (such as carrots) or a fibrous root system (such as turf grass). In both cases, the roots are what carries the water and nutrients needed for plants to grow.

Plant Parts - Stems

Stems carry water and nutrients taken up by the roots to the leaves. Then the food produced by the leaves moves to other parts of the plant. The cells that do this work are called the xylem cells. They move water. The phloem cells move the food. Stems also provide support for the plant allowing the leaves to reach the sunlight that they need to produce food. Where the leaves join the stem is called the node. The space between the leaves and the stem is called the internode. You'll find out why this is so important as the mystery develops.

Plant Parts - Leaves

Leaves are the food making factories of green plants. Leaves come in many different shapes and sizes. Leaves can be simple. They are made of a single leaf blade connected by a petiole to the stem. An oak leaf or a maple leaf are examples. A compound leaf is a leaf made up of separate leaflets attached by a petiole to the stem like an ash or a locust.

Soil for Gardening in Containers

When growing plants in containers, soil from the garden should not be used if you expect good results. Garden soil usually contains weed seeds, disease organisms, and drains poorly. If you want to use soil from the garden, it must be mixed with other things. Here's a good recipe:

1 part soil

1 part peat

1 part course sand or perlite

The peat and sand will help to improve the drainage.

Even better for growing plants in containers are artificial soils or soilless mixes. They are called artificial because they contain no soil but are made up of peat, perlite, vermiculite, and nutrients. They have a lot of plusses over soil. They are clean, lightweight, provide for excellent drainage, and easy to get. Soilless mixtures are available under several trade names such as Jiffy mix, Redi-earth, Pro mix, and Sunshine mix. Because artificial mixes contain no soil, they don't do a good job of holding on to nutrients. So, you will need to fertilize plants regularly to keep them looking good.

Composting

Composting is the natural cycle of plants living, dying, and breaking down to pass their nutrients to other plants. Compost is a source of nutrients for plants. It helps to improve the texture and fertility of the soil. You learned about texture earlier in this case.

Compost is made up of a lot of different things. Think of compost as the soil's diet. The diet should be balanced between materials that are high in nitrogen and those high in carbon, between wet and dry materials, and between acidic and basic materials.

Microorganisms in the soil break down the organic matter to make compost.

The basic compost pile is made up of layers of organic matter, sprinkled with a little soil and fertilizer, kept moist and turned to keep oxygen going through it. You can speed up the process by making the size of the organic matter smaller and by turning the pile frequently.

There are four basic ingredients in a compost pile:

- Carbon (from organic matter like leaves) provides the food for microorganisms.
- Nitrogen (the fertilizer) comes from grass clippings and dead green plants and provides the energy microorganisms need to break down the carbon.
- Water and oxygen, that microorganisms need lots of to do their job.

IV. ФАХОВІ ТЕКСТИ ДЛЯ СПЕЦІАЛЬНОСТІ «ГЕОДЕЗІЯ ТА ЗЕМЛЕУСРІЙ»

Варіант №1

HISTORY OF GEODESY

Man has been concerned about the earth on which he lives for many centuries. During very early times this concern was limited, naturally, to the immediate vicinity of his home; later it expanded to the distance of markets or exchange places; and finally, with the development of means of transportation man became interested in his whole world. Much of this early "world interest" was evidenced by speculation concerning the size, shape, and composition of the earth.

The early Greeks, in their speculation and theorizing, ranged from the flat disc advocated by Homer to Pythagoras' spherical figure-an idea supported one hundred years later by Aristotle. Pythagoras was a mathematician and to him the most perfect figure was a sphere. He reasoned that the gods would create a perfect figure and therefore the earth was created to be spherical in shape. Anaximenes, an early Greek scientist, believed strongly that the earth was rectangular in shape.

Since the spherical shape was the most widely supported during the Greek Era, efforts to determine its size followed. Plato determined the circumference of the earth to be 40,000 miles while Archimedes estimated 30,000 miles. Plato's figure was a guess and Archimedes' a more conservative approximation. Meanwhile, in Egypt, a Greek scholar and philosopher, Eratosthenes, set out to make more explicit measurements. He had observed that on the day of the summer solstice, the midday sun shone to the bottom of a well in the town of Syene (Aswan). At the same time, he observed the sun was not directly overhead at Alexandria; instead, it cast a shadow with the vertical equal to 1/50th of a circle (7° 12'). The actual unit of measure used by Eratosthenes was called the "stadia." No one knows for sure what the stadia that he used is in today's units. The measurements given above in miles were derived using one stadia equal to one-tenth statute mile. It is remarkable that such accuracy was obtained in view of the fact that most of the "known" facts and his observations were incorrect.

Another ancient measurement of the size of the earth was made by the Greek, Posidonius. He noted that a certain star was hidden from view in most parts of Greece but that it just grazed the horizon at Rhodes. Posidonius measured the elevation of the same star at Alexandria and determined that the angle was 1/48th of circle. Assuming the distance from Alexandria to Rhodes to be 500 miles, he computed the circumference of the earth as 24,000 miles. While both his measurements were approximations when combined, one error compensated for another and he achieved a fairly accurate result.

Revising the figures of Posidonius, another Greek philosopher determined

18,000 miles as the earth's circumference. This last figure was promulgated by Ptolemy through his world maps. The maps of Ptolemy strongly influenced the cartographers of the middle ages. It is probable that Columbus, using such maps, was led to believe that Asia was only 3 or 4 thousand miles west of Europe. It was not until the 15th century that his concept of the earth's size was revised. During that period the Flemish cartographer, Mercator, made successive reductions in the size of the Mediterranean Sea and all of Europe which had the effect of increasing the size of the earth.

The telescope, logarithmic tables, and the method of triangulation were contributed to the science of geodesy during the 17th century. In the course of the century, the Frenchman, Picard, performed an arc measurement that is modern in some respects. He measured a base line by the aid of wooden rods, used a telescope in his angle measurements, and computed with logarithms. Cassini later continued Picard's arc northward to Dunkirk and southward to the Spanish boundary. Cassini divided the measured arc into two parts, one northward from Paris, another southward. When he computed the length of a degree from both chains, he found that the length of one degree in the northern part of the chain was shorter than that in the southern part. This unexpected result could have been caused only by an egg-shaped earth or by observational errors.

The results started an intense controversy between French and English scientists. The English claimed that the earth must be flattened, as Newton and Huygens had shown theoretically, while the Frenchmen defended their own measurement and were inclined to keep the earth egg-shaped.

To settle the controversy, once and for all, the French Academy of Sciences sent a geodetic expedition to Peru in 1735 to measure the length of a meridian degree close to the Equator and another to Lapland to make a similar measurement near the Arctic Circle. The measurements conclusively proved the earth to be flattened, as Newton had forecast. Since all the computations involved in a geodetic survey are accomplished in terms of a mathematical surface (reference ellipsoid) resembling the shape of the earth, the findings were very important.

Варіант №2

GEODETIC SURVEYING TECHNIQUES (part I)

Four traditional surveying techniques (1) astronomic positioning, (2) triangulation, (3) trilateration, and (4) traverse are in general use for determining the exact positions of points on the earth's surface.

Horizontal positioning. Astronomic Position Determination

Astronomic positioning is the oldest positioning method. It has been used for many years by mariners and, more recently, by airmen for navigational purposes. Geodesists must use astronomic positions along with other types of survey data such as triangulation and trilateration to establish precise positions.

As the name implies, astronomic positions are obtained by measuring the angles between the plumb line at the point and a star or series of stars and recording the precise time at which the measurements are made. After combining the data with information obtained from star catalogues, the direction of the plumb line (zenith direction) is computed.

While geodesists use elaborate and very precise techniques for determining astronomic latitude, the simplest method, in the northern hemisphere, is to measure the elevation of Polaris above the horizon of the observer. Astronomic latitude is defined as the angle between the perpendicular to the geoid and the plane of the equator.

Astronomic longitude is the angle between the plane of the meridian at Greenwich (Prime Meridian) and the astronomic meridian of the point. Actually, it is measured by determining the difference in time-the difference in hours, minutes, and seconds between the time a specific star is directly over the Greenwich meridian and the time the same star is directly over the meridian plane of the point.

Astronomic observations are made by optical instruments-theodolite, zenith camera, prismatic astrolabe-which all contain leveling devices. When properly adjusted, the vertical axis of the instrument coincides with the direction of gravity and is, therefore, perpendicular to the geoid. Thus, astronomic positions are referenced to the geoid.

Triangulation

The most common type of geodetic survey is known as triangulation. It differs from the plane survey in that more accurate instruments are used, instrumental errors are either removed or predetermined. Another very important difference is that all of the positions established by triangulation are mathematically related to each other.

Basically, triangulation consists of the measurement of the angles of a series of triangles. The principle of triangulation is based on simple trigonometric procedures. If the distance along one side of a triangle and the angles at each end of the side are accurately measured, the other two sides and the remaining angle can be computed. Normally, all of the angles of every triangle are measured for the minimization of error and to furnish data for use in computing the precision of the measurements. Also, the latitude and longitude of one end of the measured side along with the length and direction (azimuth) of the side provide sufficient data to compute the latitude and longitude of the other end of the side.

There are four general orders of triangulation. First-Order (Primary Horizontal Control) is the most accurate triangulation. It is costly and time-consuming using the best instruments and rigorous computation methods. First-Order triangulation is usually used to provide the basic framework of horizontal control for a large area such as for a national network. It has also been used in preparation for metropolitan expansion and for scientific studies requiring exact geodetic data. Its accuracy should be at least one part in 100,000. Second-Order, Class I (Secondary Horizontal Control) includes the area networks between the First-Order arcs and detailed surveys in very high value land areas. It should indicate an accuracy of at least one part in 50,000. The demands for reliable horizontal control surveys in areas which are not in a high state of development or where no such development is anticipated in the near future justifies the need for a triangulation classified as Second-Order, Class II (Supplemental Horizontal Control). This class is used to establish control along the coastline, inland waterways and interstate highways. The control data contributes to the National Network and is published as part of the network. The minimum accuracy allowable in Class II of Second-Order is one part in 20,000. Third-Order, Class I and Class II (Local Horizontal Control) is used to establish control for local improvements and developments, topographic and hydrographic surveys, or for such other projects for which they provide sufficient accuracy. Its accuracy should be at least one part in 10,000 for Class I and one part in 5,000 for Class II. The sole accuracy requirement for Fourth-Order triangulation is that the positions be located without any appreciable errors on maps compiled on the basis of the control. Normally, triangulation is carried out by parties of surveyors occupying preplanned locations (stations) along the arc and accomplishing all the measurements as they proceed.

Варіант №3

GEODETIC SYSTEMS (PART I)

A datum is defined as any numerical or geometrical quantity or set of such quantities which serve as a reference or base for other quantities. In geodesy two types of datums must be considered: a horizontal datum which forms the basis for the computations of horizontal control surveys in which the curvature of the earth is considered, and a vertical datum to which elevations are referred. In other words, the coordinates for points in specific geodetic surveys and triangulation networks are computed from certain initial quantities (datums).

Horizontal Geodetic Datums

A horizontal geodetic datum may consist of the longitude and latitude of an initial point (origin); an azimuth of a line (direction) to some other triangulation station; the parameters (radius and flattening) of the ellipsoid selected for the computations; and the geoid separation at the origin. A change in any of these quantities affects every point on the datum.

In areas of overlapping geodetic triangulation networks, each computed on a different datum, the coordinates of the points given with respect to one datum will differ from those given with respect to the other. The differences occur because of the different ellipsoids used and the probability that the centers of each datum's ellipsoid is oriented differently with respect to the earth's center. In addition, deflection errors in azimuth cause a relative rotation between the systems. Finally, a difference in the scale of horizontal control may result in a stretch in the corresponding lines of the geodetic nets.

Datum Connection

There are three general methods by which horizontal datums can be connected. The first method is restricted to surveys of a limited scope and consists of systematic elimination of discrepancies between adjoining or overlapping triangulation networks. The second one is the gravimetric method of Physical Geodesy and the third – the methods of

Satellite Geodesy. These methods are used to relate large geodetic systems to each other and/or to a world system. Both the gravimetric and satellite methods produce necessary "connecting" parameters from reduction of their particular observational data.

Vertical Datums

Just as horizontal surveys are referred to specific original conditions (datums), vertical surveys are also related to an initial quantity or datum. Elevations are referred to the geoid because the instruments used either for differential or trigonometric leveling are adjusted with the vertical axis coincident to the local vertical. As with horizontal datums, there are many discrepancies among vertical datums. There is never more than 2 meters variance between leveling nets based on different mean sea level datums; however, elevations in some areas are related to surfaces other than the geoid; and barometrically determined heights are usually relative.

In the European area, there are fewer vertical datum problems than in Asia and Africa. Extensive leveling work has been done in Europe and practically all of it has been referred to the same mean sea level surface. However, in Asia and Africa the situation has been different. In places there is precise leveling information available based on mean sea level. In other areas the zero elevation is an assumed elevation which sometimes has no connection to any sea level surface. China has been an extreme example of this situation where nearly all of the provinces have had an independent zero reference. There is very little reliable, recent, vertical data available for much of the area of Africa and Asia including China.

The mean sea level surface in the United States was determined using 21 tidal stations in this country and five in Canada. This vertical datum has been extended over most of the continent by first-order differential leveling. Concurrent with the new adjustment of the horizontal network, mentioned previously, is the readjustment of the vertical network. Countries of North and Central America are involved. In the conterminous United States 110,000 kilometers of the basic network are being releveled.

Варіант №4

PHYSICAL GEODESY (part 1)

Physical geodesy utilizes measurements and characteristics of the earth's gravity field as well as theories regarding this field to deduce the shape of the geoid and in combination with arc measurements, the earth's size. With sufficient information regarding the earth's gravity field, it is possible to determine geoid undulations, gravimetric deflections, and the earth's flattening.

In using the earth's gravity field to determine the shape of the geoid, the acceleration of gravity is measured at or near the surface of the earth. It might be interesting to compare the acceleration measured by the gravimetrist and the acceleration experienced in an airplane. In an airplane, the acceleration is simply called a G force and is measured by a G meter. A G factor of one is used to indicate the acceleration due to the attraction of the earth and is considered a neutral condition. The gravity unit used and measured in geodesy is much smaller. A G factor of one is approximately equal to one thousand gals, a unit named after Galileo. The still smaller unit used in geodesy is the milligal (mgal) or one-thousandth part of a gal. Thus, in geodesy we are dealing with variations in acceleration equal to one millionth of one G aircraft acceleration. The most accurate modern instruments permit measurement of acceleration changes of one hundred millionth part of the well known G factor or better.

Gravity Measurements

Two distinctly different types of gravity measurements are made: absolute gravity measurements and relative gravity measurements. If the value of acceleration of gravity can be determined at the point of measurement directly from the data observed at that point, the gravity measurement is absolute. If only the differences in the value of the acceleration of gravity are measured between two or more points, the measurements are relative. *Absolute measurement of gravity*

Until the middle of the 20th century, virtually all absolute measurements of gravity were made using some type of pendulum apparatus. The most usual type of apparatus contained a number of pendulums that were swung in a vacuum. By measuring the peroid of the pendulums, the acceleration of gravity could be computed. In 1818, Kater developed the so-called reversible pendulum that had knife edge pivots at both ends. These pendulums were flipped over (reversed) during the measurements and, using this procedure, a number of important error sources were eliminated. Still, there were numerous other problems and error sources associated with pendulum measurements of absolute gravity, and the results obtained were not sufficiently accurate to meet the needs of geodetic gravimetry. Consequently, in recent years, the pendulum method has been superseded by the ballistic method which is based on timing freely falling bodies. The acceleration of gravity can be determined by measuring the time taken by a body to fall over a known distance.

Relative measurement of gravity

Solution of some of the problems of gravimetric geodesy requires knowledge of the acceleration of gravity at very many points distributed uniformly over the entire surface of the earth. Since absolute gravity measurements have been too complicated and time consuming and, until recently, could not be obtained with sufficient accuracy, relative gravity measurements have been used to establish the dense network of gravity measurements needed. The earliest relative gravity measurements were made with reversible pendulums. The most accurate relative pendulums to be developed were the Gulf quartz pendulum and the Cambridge invar pendulum. These two instruments were used as late as 1969.

Modern relative gravity measurements are made with small, very portable, and easily used instruments known as gravimeters (gravity meters). Using gravimeters, highly accurate relative measurements can be made at a given site, known as a gravity station, in half-an-hour or less. Modern gravimeter-type instruments were first developed in the 1930's. There are two other important considerations when relative gravity measurements are made: drift and base station connections. Gravimeter drift is a phenomenon related to certain instrumental instabilities that cause the dial reading to change slowly with time even when the acceleration of gravity remains constant. Since relative gravity surveys can determine only differences in gravity from point to point, every relative gravity survey must include measurements at one or more reoccupiable points where acceleration of gravity is known. Such points are called base stations. Then all gravity difference measurements are computed with respect to the known gravity value at the base station. Hence, tying a relative gravity survey to a base station establishes the "gravity datum" of that survey. The earliest "gravity datum" was the so-called Potsdam System. The Potsdam system, however, was found to be in error and, in 1971, was replaced by the International Gravity Standardization Net 1971 (IGSN71).

Варіант №5

PHYSICAL GEODESY (part 2)

Gravity measurement at sea

The earliest measurements at sea were made by F.A. Vening Meinesz who, in 1927, installed a pendulum apparatus in a submarine.

The submarine pendulum gravity measurements of Vening Meinesz are mainly of historical interest today. The first gravimeters installed in surface ships appeared during the 1950's. These early ocean surface gravity measurements were only of modest accuracy and, again, now are mainly of historical value. Reasonably accurate measurements from gravimeters on surface ships date only from the late 1960's. Instruments used include LaCosteRomberg S Meter, Askania Meter, Bell Meter, and the Vibrating String Gravimeter. All of these meters are compensated to minimize the effects of oscillatory motion of the ship due to ocean surface waves. The effects are also eliminated or averaged out by computational techniques. A big problem with ocean surface measurements is that the forward motion of the ship adds a centrifugal reaction component to measured gravity which must be eliminated by the so-called Eotvos correction. Therefore, the ship's velocity and heading, as well as the ship's position, must be known accurately. Near shore, shore based electronic positioning/navigation systems (such as LORAN) are used. In the deep ocean, satellite navigation and inertial systems must be used.

Gravity measurement in the air

Problems in airborne gravity measurements are similar to those encountered for surface ships. The position, velocity, and heading of the aircraft must be known accurately. Because of the higher aircraft speeds, the Eotvos correction is much larger for airborne measurements than for surface ship measurements. It also is very difficult to compensate for spurious aircraft accelerations. In addition, reduction of the gravity value from aircraft altitude to an equivalent surface value is a problem that has not yet been solved satisfactorily.

Gravity Anomalies

Gravity measurements provide values for the acceleration of gravity at points located on the physical surface of the earth. Before these measurements can be used for most geodetic purposes, they must be converted into gravity anomalies.

A gravity anomaly is the difference between a gravity measurement that has been reduced to sea level and normal gravity. Normal gravity, used to compute gravity anomalies, is a theoretical value representing the acceleration of gravity that would be generated by a uniform ellipsoidal earth. By assuming the earth to be a regular surface without mountains or oceans, having no variations in rock densities or in the thickness of the crust, a theoretical value of gravity can be computed for any point by a simple mathematical formula. The most common type of gravity anomaly used for geodetic applications is the so-called free-air gravity anomaly.

Undulation and Deflections by the Gravimetric Method

The method providing the basis from which the undulations of the geoid may be determined from gravity data was published in 1849 by a British scientist, Sir George Gabriel Stokes. However, the lack of observed gravity data prevented its application until recent years. In 1928, the Dutch scientist, Vening Meinesz, developed the formulas by which the gravimetric deflection of the vertical can be computed. The computation of the undulations of the geoid and the deflections of the vertical require extensive gravity observations. The areas immediately surrounding the computation point require a dense coverage of gravity observations and detailed data must be obtained out to distances of about 500 miles. A less dense network is required for the remaining portion of the earth. While the observational requirements for these computations appear enormous, the results well justify the necessary survey work. Effective use of the gravimetric method is dependent only on the availability of anomalies in sufficient quantity to achieve the accuracy desired. Successful use of Stoke's integral and Vening-Meinesz formulas depends on a good knowledge of gravity anomalies in the immediate vicinity of the point under consideration and a general knowledge of anomalies for the entire earth.

There are many large regions on the continents where gravity measurements are lacking or available only in small quantities. Gravity data for ocean areas has always been sparse, however, Satellite Altimetry has overcome this deficiency. In regions where an insufficient number of gravity measurements exists, some other approach must be used to obtain or predict the mean gravity anomalies for the areas.

Correlations exist between variations in the gravity anomaly field and corresponding variations in geological, crustal, and upper mantle structure, regional and local topography and various other types of related geophysical data. In many areas where gravity information is sparse or missing, geological and geophysical data is available. Therefore, the various prediction methods take into account the actual geological and geophysical cause of gravity anomalies to predict the magnitude of the anomalies.

Варіант №6

CREATION OF GEODETIC SATELLITE NETWORK (part 1)

Methods and technologies of geodetic satellite survey based on GNSS methods are widely used for creation of reference geodetic networks, field aerial survey control point referencing , on-board positioning of aerial imagery photos perspective centres, field topographic survey, land management and cadastre works, monitoring of critical objects.

In the modern world geodetic base network is usually created with the use of global navigation satellite systems (GNSS) GLONASS/GPS principally by application of a differential method. The differential method is the most efficient where there is a network of reference (base) stations with specified geodetic coordinates. Application of the differential method provides for spatial objects' coordinate setting of +/-2 cm accuracy in real time and +/-5 cm in post-processing.

Satellite geodetic network consisting of reference stations can be used for solution of the following tasks: geodesy, cartography, cadastre; planning, construction, exploitation of automobile and railroads; navigation and security control of automobile, railway, air, river and marine transport; planning, construction and exploitation of buildings and engineering constructions, complex engineering objects: bridges, tunnels, oil and gas pipelines, etc.; real-time monitoring of critical objects.

Digital aerial survey

Digital aerial survey is performed with the use of modern topographic mapping aerial survey systems of high productivity, geometric accuracy, spatial resolution and photometric radiometric image quality.

Aerial survey data obtained with the use of full large-format digital aerial cameras is presented in a set of colour and multispectral images in four spectral ranges (red, green, blue, near infrared). Imagery in spectral channels can be used for creation of spectrozonal color-infrared images which possess high decoding interpretation features ability.

Digital aerial survey is performed with the use of on-board positioning and orientation systems which allow direct in-flight determination of imagery horizontalization exterior orientation parameters and thus cutting of expenses on field aerial ground control points referencing survey and the timing of work performance.

Apart from field aerial survey performed at the vertical position of a visual optical axis, oblique aerial survey (tilted visual optical axis) can be performed as well, which allows more efficient spotting recognition of objects and analyzing of their relative spatial position.

Digital aerial survey is efficiently applied for solution of the following tasks:

creation and updating of topographic and special plans maps; creation of the mapping base for real estate cadastre; ecology and nature management (agriculture and forestry); monitoring of various objects; creation of 3D models of objects and territories; reaction to emergencies; creation of visual information systems.

Aerial laser scanning

Aerial laser scanning (lidar aerial survey) implies optic-mechanical scanning of an area by high-frequency pulse laser emission (for instance, 150 kHz), receiving and registration of a signal (pulse) reflected from the object's surface, determination of the distance from the reflection point and coordinates setting computation of the reflection point laser scanning points.

In order to ensure compute coordinates of laser scanning points (LSP) the aerial laser scanning system (aerial survey lidar) comprises equipped with a positioning and orientation system providing on the base of GNSS and inertial measurements for location position and orientation of a laser scanning system at the moment of pulse emission. This allows acquiring a high-density cloud of laser reflection points with set spatial coordinates.

Aerial laser scanning data is used for: topographic terrain survey and creation of high-accuracy detailed 3D terrain models; lidar survey has unquestionable advantages in solution of this task as this technology provides for high-accuracy survey and point density and allows coordinate setting to get laser reflection scanning points even in forest areas under the canopy; creation of 3D network models of territories and objects (surface models); 3D modelling of buildings and constructions, built-up territories; inspection of electric-technical objects (highvoltage power transmission lines, electric substations, etc.); inspection of transport infrastructure objects; bathymetry of inland water-storage bodies reservoirs and the shelf (with use special kind of laser scanning system); inventory and monitoring of forests; inventory of the land and asset complex; monitoring of big engineering objects, for instance, open mines of natural resources.

Laser scanning data processing is performed by a software complex Terra Scan H and TerraModeler based on MicroStation.

Варіант №7

CREATION OF GEODETIC SATELLITE NETWORK (part 2)

Thermal aerial survey

Thermal aerial survey is registration of electromagnetic objects' emission in thermal infrared spectrum range and its reflection in an image and representation of its result like an image.

Thermal emission, whose intensity depends on temperature, can be detected by thermal detectors and transformed into a visible image showing differences in objects' temperature. Thermal survey can be performed both in day and at night time.

At thermal-range Earth remote sensing transmission windows are used with a 3-5, 8-

14 micrometer wave length. This range shows own emission of earth surface objects.

Thermal vision observation is a type of thermal control for which a thermal observation device is used as measuring equipment. The thermal observation device allows ―seeing the heat‖ and detecting a thermal image on the display. The main distinctive feature of this method is that the thermal observation device allows seeing what cannot be seen with an unaided eye. Man's eye cannot detect objects' temperature, but the thermal observation device is capable of showing its display a

+/-1 °C accuracy thermogram of an object.

Thermal survey application areas are engineering applications, ecology, forest resources management, agriculture, engineering geology and hydrology.

Georadar sensing

Georadar sensing is performed with the use of georadars operating at depths up to 5 m and a 20 cm resolution and providing for detection of density fluctuations of the surveyed surface at creation of georadiolocation profile, thus enabling this method to reveal underground communications including those without a temperature contrast.

Georadiolocation or georadar survey is a modern non-destructing method of soil and construction base inspection which implies analysis of pulses reflected from boundaries of spheres with different electrophysical characteristics.

Modern georadars are a powerful geophysical instrument whose application provides for acquisition of large amounts of detailed data during a relatively short time period. Application of a georadar for survey allows creation of a high-reliability volumetric picture during analysis of different spheres at varied depths.

Georadar survey is used for inspection of: soil, which allows detecting the composition and width of layers, presence of frozen or over-moisturized areas, land slide processes and tectonic distortions, cavities, deconsolidation areas, underground communications, boundaries of soil and anthropogenic waters, etc.; automobile roads, which allows assessing the width of road surface construction layers, types, humidity and density of soil and under-surface base; location of soil water levels, location of a sliding curve at land slide areas, spatial contour of geologic horizon base under a back of ballast bed, locations of deconsolidated soil, cavities and infiltration of underground waters; bases and industrial floorings; constructions of buildings (beams, floors, pillars, etc.), which allows detection of inner cracks, uneven settlement, presence of iron reinforcement and its deformation, infringement of construction regulations and project requirements, assess the density and toughness of materials; ice situation, which allows performing control of the width and condition of ice both during freeze-up and flood water periods.

In automobile roads planning the economic effect of application of 3D models acquired with the use of georadars is reached due to reduction of drilling operations with a several-times' enhancement of reliability of the engineering-geologic data, choosing of efficient reconstruction and overhaul types differentiated by automobile road areas.

Exploitation of a shelf zone requires acquisition of data on sea bottom condition, underwater and on-surface constructions. A modern method of sea bottom, underwater and on-surface construction inspection implies analysis of pulses reflected from boundaries of spheres with different electrophysical characteristics.

The georadiolocation method allows observation of ice for assessment of its width, monitoring in the areas of automobile ice passages, winter trails, detection and localization of uneven areas inside ice massives.

Georadiolocation survey can be performed by contact - shifting a georadar antenna on the ice surface, and non-contact - placing a georadar on board an aerial survey aircraft with the use of a side-looking locator.

Варіант №8

CREATION OF GEODETIC SATELLITE NETWORK (part 3)

Hydrographic research

Hydrographic research is a survey process of separate hydrosphere areas which includes scientific design, performance of hydrographic works, processing and analysis of their results. The contents of a hydrographic survey are determined by the composition and amount of the data the Orderer Customer requires.

Similar to assessment of altitude determination of large numbers of points in an area during topographic earth terrain survey, in hydrography for survey of underwater terrain depths are measured in all surveyed area. In fact, hydrographic works are a continuation of topographic and geodetic works in the areas of the World Ocean and inland waters.

But qualities of every geographic sphere and specific purposes lead to important features both in operational methods and applied means. What are these features? First of all, the necessity of special carriers for measuring equipment. When in shore survey geodetic and topographic devices can be placed directly in any point of the surveyed area, for performance of underwater terrain survey as well as other types of hydrographic operations special platforms shall be used and duly equipped to be kept on water surface or under water. Surface vessels and deep-sea submersibles are used as such platforms. Only at complete freezing of a water zone survey can be performed directly from the ice surface.

Further, the platform with the mounted equipment will move in order to perform survey of all water zone of the surveyed area. Consequently, its position is changing non-stop. Even if the vessel is anchored, its shift must be taken into consideration. It is evident that for attribution of measurement results to any fixed point the measurements will be performed very fast. The said circumstance entails the following important feature of hydrographic works: they will be accompanied with frequent and precise coordinate setting of a point in which the measurements were carried out. Ideally, it should be determined non-stop so that measurements at any moment would be linked with the real place.

The purpose of the survey is not only to reliably determine mutual location of different objects at sea, but also to specify the precise location of surveyed objects on the Earth surface. To achieve this, their planned fixing shall be made to a uniform coordinate system of the earth ellipsoid. In on-surface survey planned fixing is made with the use of geodetic networks. At sea there are no such networks, which lead to significant features of plan substantiation of hydrographic works.

The modern hydrographic survey complex includes survey of the following main elements: underwater terrain; sea shores; sea bottom soil; geophysical fields; oceanographic and hydrologic characteristics.

Measurements and observations carried out in water zones and in the process of hydrographic survey are called hydrographic works.

TrueOrtho

A digital orthophoto is simply a photographic map that can be used to measure true distances. It is an accurate representation of the earth's surface. To create a digital orthophoto, several key input files are necessary: aerial photos with a highpercentage overlap, scanned imagery, aerotriangulation (A.T.) results, and a digital elevation model (DEM). Scanned imagery can be obtained from scanning aerial photo diapositives or negatives on an image-quality scanner. The A.T. results include a camera calibration report and the ground control. At a minimum, the DEM can be a regularly spaced grid of masspoints, each containing an x, y, and z value. A more robust digital terrain model (DTM) can also be used because it includes strategically placed masspoints, dense breaklines, and ridgelines.

Digital orthophotography is a resource being utilized by a significant portion of GIS users. It has become a popular base layer in modern GIS. With the price of disk space dropping and the speed of computers increasing, digital orthophotos are a viable option for building a fully developed GIS. Digital orthophotos can be used for technically specific needs such as planimetric or cadastral mapping; utility data capture and quality control; and accurate project analysis and design implementations.

Digital orthophotos can also be used to explain projects and issues to the general public because real-world pictures are easier for the untrained eye to understand. They contain landmarks and recognizable places. For example, digital imagery can help an audience visualize the new light rail corridor by showing existing conditions. Proposed changes can be overlaid as vector information. The world is constantly changing, and digital orthophotography can help monitor change.

Варіант №9

GEODETIC USE OF GLOBAL DIGITAL TERRAIN AND CRUSTAL DATABASES IN GRAVITY FIELD MODELING AND INTERPRETATION

(part 1)

Current terrestrial and satellite observation methods and the corresponding data analysis procedures lead to the construction of global digital databases for the description of the earth's crust and topography with an increasing resolution and accuracy. Today global digital terrain models are available, which can reach a spatial resolution of up to 30×30 meters. However, such a resolution is neither global nor homogeneous and can only be achieved over continents. The question of mapping the ocean topography still remains mainly a methodological task with the major contribution being the inversion of altimetric data and altimetry-derived surface gravity data to produce the corresponding interface, i.e. the relief of the oceanic bottom separating water from oceanic crust. The production of global crustal models on the other hand is based on the exploitation of active seismic data, the compilation of available geological information and the generalization that physical properties of certain tectonic types have global character and can be assigned to similar tectonic settings. Using this methodological approach the model CRUST 5.1 and its follow-up CRUST 2.0 provide a global representation of the geometry and consistency of six (seven, if one includes ice thickness) distinct crustal layers starting from the visible topographic relief and expanding down to the crust-mantle boundary with a unified resolution of 5×5 and 2×2 respectively. The geometry of the last layer of a global crustal model provides directly a global estimate of the Mohorovicic discontinuity, information that can be opposed either regionally or globally to other independent sources of Moho data. A further example of exploiting the global crustal data is for local or regional applications of gravity field modeling, where the shape and density data emerging from the database can be used in the frame of some forward or inverse modeling procedure. However, the main asset of global digital databases with direct relation to gravity field analysis is the spatial resolution of the respective datasets.

The exploitation of this information is linked to the spectral analysis of the global geographical grids and leads to the computation of a particular class of gravity field coefficients, the so-called topographic/isostatic (t/i) spherical harmonic coefficients. The highest degree and order up to which these coefficients can be evaluated depends in this case solely on the spatial analysis of the input information, i.e. the global terrain or crustal data. The denser these global grids are, the higher the maximum degree and order of the corresponding t/i spherical harmonic sets. Thus, the incorporation of dense global digital terrain and crustal data in the appropriate spherical harmonic analysis scheme enables the retrieval and therefore interpretation of the high and very high frequencies of the observed gravity field.

The analysis of global digital terrain and crustal databases leads to the recovery of the medium to high frequencies of the observed gravity field signal. The continuous release of databases with very high resolution enables furthermore the retrieval of the very high frequency part.

Варіант №10

GEODETIC USE OF GLOBAL DIGITAL TERRAIN AND CRUSTAL DATABASES IN GRAVITY FIELD MODELING AND INTERPRETATION (part 2)

The significance of the obtained topographic/isostatic models is twofold. On the one hand they provide a direct insight to the corresponding bandwidth of the observed gravity field in terms of their dimensionless potential harmonic coefficients. At the same time they act complementary to other gravity field information, especially when it does not contain information on the small wavelength features of the gravity field, e.g. the currently available satellite-only gravity field models. In this way the geometrical and physical data of the databases can assist the challenging task of gravity field analysis and interpretation. With the resolution of the available global databases steadily increasing the t/i approach presents an efficient tool for an advanced band-limited analysis for capturing, interrelating and interpreting the medium, high and very high frequency part of the observed gravity field of the available, and especially forthcoming satellite only and combined Earth gravity models at all computational scales (global, regional and local). Apart from the resolution of the input data the features of a t/i approach in terms of gravity field recovery are determined by the type of compensation that is applied to the crustal masses. The different compensation mechanisms affect the mathematical formulation of the t/i model and thus the actual computed t/i spectrum. The two standard approaches are the Airy/Heiskanen and the Pratt/Hayford isostatic hypotheses. These two models appear also in the related literature of t/i models, either for the computation of purely isostatic Earth gravity models, or in the frame of the development of synthetic Earth gravity model. The spectral representation of the t/i models that are produced from these two compensation mechanisms reveals a complementary aspect of the two isostatic hypotheses in the spectral domain. One of the main features of t/i models is their smoothing effect on the observed field, without any loss of physical information that any low-pass filtering would cause. This smoothing feature can be seen spectrally by the decrease in power of a t/i model when compared to an uncompensated topography spectrum or some observed reference gravity field. The displayed computations showed that the A/H based t/i model acts in a compensating manner for the long wavelength and most of the medium to short wavelength part of the gravity spectrum. Up to degree 400 it reduces significantly the power of the observed field, and starts to converge to the uncompensated topography spectrum for the high and very high frequencies, the part of the spectrum where the uncompensated topography coincides spectrally with the EGM2008 reference field. The P/H model on the other hand performs in a reversed manner, and thus complementary to A/H as far as its compensation effect is concerned. It shows no compensating effect for the long wavelengths, but starts to act as one would expect a t/i model to perform, only for the high and very high frequencies, where it reduces the power of the uncompensated topography and EGM2008 spectra in almost the same order of magnitude as the A/H model does in the lower degrees. This complementary feature is important and can be utilized in current gravity field analysis, as the incorporation of databases with increasing resolution permits the retrieval of even higher frequencies of the observed gravity field.

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