

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
Національний авіаційний університет

АНГЛІЙСЬКА МОВА
AIRCRAFT ELECTRICAL EQUIPMENT.
TRANSFORMERS. GENERATORS

Методична розробка
для студентів II курсу Інституту електроніки
та систем управління

Київ 2003

УДК 811.111 (076.5)
ББК Ш 143.21-14р
А 647

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Затверджено на засіданні секції філологічних
дисциплін редради НАУ 27 травня 2003 року.

А 647 **Англійська мова. Aircraft Electrical Equipment.
Transformers.Generators:** Методична розробка/ Уклад.
С.В. Сорока. – К.: НАУ, 2003. – 28 с.

Містять текстові матеріали з теми “Трансформатори
та генератори” з лексичними та граматичними вправами
згідно з навчальною програмою.

Призначена для студентів II курсу факультету
систем управління спеціальностей 7.090603
“Електротехнічні системи електроспоживання”, 7.095605
“Світлотехніка і джерела світла”.

ЗАГАЛЬНІ МЕТОДИЧНІ ВКАЗІВКИ

Методична розробка призначена для студентів II курсу Інституту електроніки та систем управління. У результаті опрацювання посібника студенти мають опанувати спеціальну лексику з тем: "Трансформатори та генератори". Основна мета розробки – навчити майбутніх інженерів користуватись спеціальною технічною літературою, розвивати стійкі навички читання, перекладу, анотування та реферування спеціальної літератури з фаху з метою використання вилученої інформації в їх професійній діяльності.

Нова лексика подана на початку кожного розділу і надалі відпрацьовується у значній кількості лексичних вправ. Лексичні вправи включають в себе: вправи на складання та переклад термінологічних словосполучень, підбір англійських та українських термінологічних еквівалентів, комунікативні вправи тощо.

Важливим етапом роботи над текстом є неодноразове читання їх вголос з метою усвідомленого розуміння нової лексики, перехід якої в розряд активного лексичного запасу студентів здійснюватиметься під час виконання лексичних вправ. Завершальним етапом роботи над текстом є їх повний та стислий переклад.

Граматичні вправи відповідають вимогам програми. Вони охоплюють найбільш загальні явища, характерні для мови науки та техніки.

UNIT 1. TRANSFORMERS

Ex.1 Pick out English equivalents to the following terms:

- | | |
|------------------------|---------------------------|
| 1) transformer | a) частота, частотність |
| 2) alternating current | b) обмотка |
| 3) device | c) значення, величина |
| 4) frequency | d) сила |
| 5) coil | e) секційна котушка |
| 6) winding | f) прилад, механізм |
| 7) value | g) трансформатор |
| 8) voltage | h) відношення, пропорція |
| 9) force | i) прилад, пристрій |
| 10) ratio | j) напруга |
| 11) tapped coil | k) котушка |
| 12) apparatus | l) змінний струм |
| 13) application | m) вживання, використання |
| 14) turn | n) оберт, поворот, виток |

Ex.2 Translate the following words:

- Ease – to ease
Couple – to couple
Supply – to supply
Desire – to desire
Transfer – to transfer
Cut – to cut
Link – to link
Turn – to turn
Remains – to remain

Ex.3 **Mind! Formula – формула (однина)**
Formulae – формули (множина)

Use these words in sentences of your own.

Ex.4 Make an oral translation of the following text. Be ready to retell it.

THE TRANSFORMER

One of the great advantages in the use of the alternating currents is the ease with which the voltage may be changed by means of a relatively simple device known as a *transformer*.

The transformer is a stationary electrical machine that transforms alternating – current energy usually from one voltage to another, the frequency remaining constant.

The basic arrangement consists of two coils of wire that are magnetically coupled to each other. One winding, called the primary, is connected to the A.C. supply, and the other winding, the secondary, produces a voltage which can have any desired value if the respective windings are suitably designed.

The winding having the higher voltage is the high – voltage or high – tension winding, the other the low – voltage or low – tension winding. If the secondary voltage is higher than that of the primary, the device is called a step – up transformer; if the secondary voltage is lower than that of primary, it is called a step – down transformer. Thus the transformer can be used to step up or step down alternating voltage.

The transfer of energy from the primary to secondary winding of the transformer depends upon the magnetic lines of force around the primary winding cutting across, or linking with, the turns of the secondary winding.

The ratio between the voltage across the primary winding and that across the secondary winding is equal to the ratio between the number of turns of the primary winding and the number of turns of the secondary winding. This relationship may be expressed in a formula as follows:

$$\frac{E_p}{E_s} = \frac{N_p}{N_s}$$

where E_p is the voltage across the primary winding, E_s is the voltage across the secondary winding ,

N_p is the number of turns in the primary winding, and N_s is the number of turns of the secondary winding.

Transformers may be constructed with two or more secondary windings to achieve both step – up and step – down relationships. A variation of the two – winding transformer is the *autotransformer*. This transformer consists of a single tapped coil. The turns between the tap and one end constitute one winding of the transformer, and the entire coil constitutes the other winding. In practice, the use of autotransformers is limited to fairly small voltage ratios, one reason being that if a break occurs anywhere in the secondary section of the winding, the primary voltage is applied to the apparatus connected to the secondary. With a high primary voltage this would give dangerous conditions. The chief uses of autotransformers are in A.C. voltage regulation and for infrequent service such as the low-voltage starting of induction motors.

Although there are many different types of transformers, and a great variety of different applications, the principles of action are the same in each case.

Ex.5 Answer the following questions:

- 1) What is called the transformer?
- 2) What does the transformer consist of?
- 3) What is connected to A.C. supply?
- 4) Does primary or secondary winding produce a voltage which can have any desired value if the respective windings are suitably designed?
- 5) What types of transformers do you know?
- 6) What is the difference between step – up and step – down transformers?
- 7) What depends upon the magnetic lines of force around the primary winding cutting across, or linking with, the turns of the secondary winding?
- 8) What is equal to the ratio between the number of turns of the primary winding and the number of the secondary winding?
- 9) What is called the autotransformer?
- 10) Why is the use of autotransformers limited?

Ex.6 Give four forms of the following verbs:

Model: to cut – cut – cut – cutting

To supply, to transfer, to change, to have, to step, to give, to occur, to apply.

Ex.7 Make the following sentences interrogative, forming all types of questions:

- 1) Thus the transformer can be used to step up or step down alternating voltage.
- 2) The basic arrangement consists of two coils of wire that are magnetically coupled to each other.
- 3) It is possible to change the voltage by means of a simple device, which is known as a transformer.

Ex.8 Fill in the gaps with the words given in brackets below and translate the sentences:

- 1) The is a stationary electrical that transforms energy usually from one to another .
- 2) The transformertwo coils of wire that arecoupled to each other.
- 3) Thewinding is connected to the A.C., and the secondaryproduces a voltage which can have any desired.....
- 4) A transformer which hassecondary voltage than that of the primary is called atransformer.
- 5) Energy motion from the primary to the secondary winding of the transformerthe magneticof force around the primary winding cutting,or linking with, theof the secondary winding.
- 6) Theconsists of a single
- 7) The chief uses of autotransformers are in A.C. voltageand for infrequent service such as the low – voltage starting of
(lines, consists of, regulation, transformer, value, winding, induction motors, voltage, machine, supply, magnetically,

alternating – current, tapped coil, autotransformer, primary, turns, depends upon, higher, across, step – up)

Ex.9 There are some grammar mistakes in each of the following sentences. Find and correct them.

- 1) The transformer is a stationary electrical machine that transform alternating – current energy from one voltage to other.
- 2) The transformer consist of two windings insulate from each other.
- 3) That winding which receives energy are the primary.
- 4) Energy may transmitted either way through the transformer.
- 5) The magnetic path is make of laminated iron.
- 6) What depend upon the magnetic lines of force?
- 7) The amount of this voltage is proportional to the number of turns in the coil, doesn't it?
- 8) Does the ratio of the primary to the secondary voltage equal to the ratio of the number of primary turns to the number of secondary turns?
- 9) A medium – size transformer have a full – load efficiency of about 97 – 98 per cent.
- 10) If the number of secondary turns greater than the primary, the secondary out voltage will be greater than the primary voltage.

Ex.10 Retell text «The Transformer » using such words and word – combinations as:

- the great advantages
- the frequency remaining constant
- are coupled to each other
- primary and secondary windings
- step – up and step – down
- relationship
- autotransformer
- infrequent service

Ex.11 Use the dictionary to look up new words that you need.

at times; circumstances; as a result; in this way; through; separate; across; unity; since; in practice; certain; substance; ring; square; further; over.

Ex. 12 Give four forms of the following verbs. Translate them:

to match; to employ; to mount; to set; to transfer; to cut; to achieve; to reduce; to keep; to place.

Ex. 13 Remember the meaning of these words and word – combinations:

impedance – імпеданс, повний опір

laminated iron core – пластинчастий залізний сердечник

load – вантаж, навантаження

coupling – сполучення, з'єднання

to leak – протікати, просуватись

leakage – витік

flux – течія, потік

reactance – реактивний опір

bar – шматок, брус, плитка, брусок

to furnish – постачати

arm – гілка

shell – оболонка, гільза

Ex. 14 Read and translate the text.

TRANSFORMERS

At times, a maximum transfer of power is desired even through the impedance of the load does not match that of the source. Under such circumstances we may employ an impedance-matching device, called a transformer.

A transformer consists of a laminated iron core forming a closed magnetic circuit on which two separate windings are mounted. If an alternating current is set flowing in one of these coils (called the primary winding), the varying magnetic field set up around that coil will cut across the turns of the second coil (called the secondary winding). As a result, an induced voltage is produced across this secondary winding. In this way electric energy is transferred from the primary to the secondary circuit.

If the impedance of the primary winding matches that of the source and the impedance of the secondary winding matches that of the load, an impedance match is effected between the source and load.

The transfer of energy from the primary to the secondary winding of the transformer depends upon the magnetic lines of force around the primary winding cutting across, or linking with, the turns of the secondary winding. In an ideal transformer, all these lines of force would link up with all the turns of the secondary winding, achieving 100 percent (or unity) coupling. Since this is impossible to achieve in practice, a certain amount of the magnetic lines of force will leak off into the air. We call this leakage flux, and its effect is termed leakage reactance.

To reduce this leakage flux, the primary and secondary winding may be wound on a core of iron or other magnetic substance. This tends to concentrate the lines of force and to keep them from leaking off. If this core is in the form of a straight bar, we have what is called an open-core transformer.

More frequently this core is in the form of a closed ring or square. Thus, a closed magnetic circuit is furnished, and the leakage flux is reduced further. We call this type a closed-core transformer.

Another type of transformer, which is called shell – core type, is widely used in electricity too. The primary and secondary windings are placed one over the other on the center arm of the core. The shell-core transformer can be designed to produce a coupling that closely approaches unity, or 100 percent.

Ex.15 Answer the following questions to the text:

- 1) What components does a transformer consist of?
- 2) What will happen if an alternating current is set flowing in the primary winding?
- 3) How is electric energy transferred from the primary to the secondary windings?
- 4) What can you say about the ideal transformer's lines of force?
- 5) What is called leakage flux and leakage reactance?
- 6) What is necessary for reducing leakage flux?
- 7) Which device is called an open-core transformer?
- 8) If the core is in the form of a closed ring or square, the transformer is called an air-core transformer, isn't it?

9) What can you say about the structure of the transformer of shell-core type?

Ex.16 Comment on the text “Transformers”, using such constructions as:

It is well known that.....

It goes without saying.....

As far as I know.....

In my opinion.....

Data are given about.....

It is shown that.....

As a result.....

It is impossible.....

Ex.17 **Mind!** Use words below to make up sentences of your own.

Maximum (однина) - **maxima** (множина) – максимум (и)

Medium (однина) – **media** (множина) – середовище, середовища

Minimum (однина) – **minima** (множина) – мінімум (и).

Ex.18 Put questions to the italicized words.

- 1) As a result, an induced voltage is produced *across this secondary winding*.
- 2) *In this way* electric energy is transferred from the primary to the secondary windings.
- 3) A certain amount of the magnetic lines of force will leak off *into the air*.
- 4) The primary and secondary windings may be wound on a core of *iron or other magnetic substances*.
- 5) More frequently this core is in the form of a *closed ring* or square.
- 6) *The primary and secondary windings* are placed one over the other on the center arm of the core.

Ex.19 Work in small groups. Compare the open-core transformers, closed-core transformers and shell-core ones. What similarities and differences are there?

Ex. 20. Write down all unknown words from the text "Autotransformers". Find out their meanings in the polytechnics dictionary.

Ex. 21. Read and translate the text.

AUTOTRANSFORMERS

The transformer effect can be obtained with a single tapped winding instead of separate primary and secondary windings. The arrangement is called an *autotransformer*. In the primary winding represents the whole coil, the secondary voltage will be substantially the same proportion of the applied voltage as the proportion between the turns up to the secondary tapping and the total number of turns. By interchanging the voltages so that the supply is connected to the smaller number of turns, a voltage larger than the supply voltage appears across the whole coil. The autotransformer can thus be used to obtain a higher or lower than the supply, as in the case of the conventional transformer with two separate windings.

In practice, the use of autotransformers is limited to fairly small voltage ratios, one reason being that if a break occurs anywhere in the secondary section of the winding, the primary voltage is applied to the apparatus to the secondary. With a high primary voltage this would give dangerous conditions. The chief uses of autotransformer are in A.C. voltage regulation and for infrequent service such as the low-voltage starting of induction motors.

Ex. 22 Make the word - combinations using given in lines 1-2.

1. induction, conventional, total, primary, infrequent, chief, dangerous, single-tapped, voltage.
2. winding, conditions, winding, motors, regulations, number, transformer, uses, service.

Ex. 23. Put 10 key-questions to the text "Autotransformers".

Ex. 24. Tell briefly about the autotransformers and their uses.

Ex.25 Translate from Ukrainian into English.

а) переносити (передавати); секційна котушка; відношення (пропорція); виток; зменшувати; пластинчастий залізний сердечник; реактивний опір; залежати від; напруга; змінний струм; силові лінії; вторинна обмотка; навантаження; витік; складатись з; течія (потік); обставини; формули; сполучення (з'єднання); застосовувати; зберігати; через; час від часу; з'єднувати(ся); середовища; окремий; неможливо; кільце; мінімум; досягати (добиватись); первинна обмотка.

в) 1. Трансформатор складається з пластинчастого залізного сердечника та двох окремих обмоток: первинної і вторинної.

2. Існує багато різних типів трансформаторів, але принцип дії будь-якого типу трансформатора схожий з іншим.

3. Первинна обмотка трансформатора приєднується до джерела струму, а вторинна обмотка виробляє напругу певної величини.

4. Автотрансформатор використовується для регулювання напруги змінного струму.

5. Потужний трансформатор радіоприймача може складатись з однієї первинної обмотки і двох окремих вторинних обмоток, що мають спільний сердечник.

6. Трансформатор в однаковій мірі може використовуватись як для підвищення, так і зниження змінного струму.

7. Чи дорівнює потужність первинної обмотки потужності вторинної обмотки?

8. Напруга вторинної обмотки збільшилась в 3 рази, чи не так?

9. Щоб зробити такі зміни, потрібна певна кількість енергії. Ця енергія іде з джерела струму?

10. У результаті, якщо існує замкнутий контур, індукований струм надходить до вторинної обмотки.

11. У первинному колі струм виробляється генератором, проходить через первинну котушку і повертається назад до генератора, чи не так?

12. У результаті магнітного поля, чи чогось іншого, лише невелика кількість електричного струму протікає через первинне коло?

13. За яких умов електричний струм протікає через вторинне коло?

14. Що відбувається зі струмом при зменшенні навантаження?

15. В ідеальному трансформаторі, енергія, що витрачається і первинним і вторинним колом, є однаковою?

UNIT 2. GENERATORS

Exercise 1. Remember the meaning and pronunciation of these terms:

generator	– генератор
rotating machine	– машина, що обертається
to convert	– перетворювати
induction	– індукція
alternating current	– змінний струм
alternator	– синхронний генератор
direct current	– постійний струм
field poles	– полюси збудження
pole pieces	– сердечники полюсів збудження
field winding	– обмотка збудження
armature	– якір, арматура
outer frame	– зовнішня рама
cylinder	– циліндр
laminated iron	– пластинчасте залізо
bearings	– підшипники
aircraft engine	– двигун літака
longitudinal slots	– повздовжні пази
armature coil	– якірна котушка
slip-rings	– контактні кільця
carbon brushes	– вуглецеві щітки
external circuit	– зовнішнє електричне коло
to rectify	– випрямляти
load	– навантаження, вантаж
shaft	– вал
commutator	– комутатор, колектор

copper segment – мідні сегменти

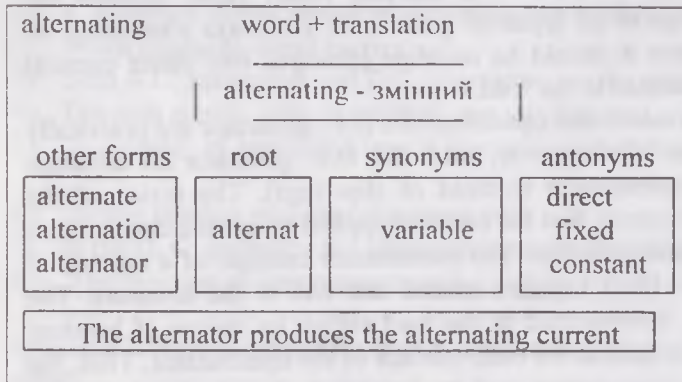
Exercise 2. Translate the following word-combinations. Give a list of antonyms to all of them:

rotating machine, even in number, outer circuit, outside circuit, outer surface.

Exercise 3. Complete the word-mapping of the following words as to the model:

Electricity, to rotate, mechanical, respective, to rectify

Model:



Exercise 4. Read and translate the text.

GENERATORS

An electric generator is a rotating electrical machine that converts mechanical energy into electrical one. It produces a current flow by induction, without any physical or electrical contact. A generator which produces an alternating current is called an alternating current generator or an alternator.