**Тема:** **Amplifier**

**Цели:** Активизировать в речи учащихся использование новой лексики, связанную с усилителем.

**Задачи**:

1) читать текст с пониманием основного содержания

2) воспринимать текст на слух, добиваясь в случае необходимости понимания с помощью переспроса, уточняющих реплик;

 3) повторение лексического материала

**Тип урока:** Обяснение новой темы

**Оборудование:** ИКТ, лекция соответствующая содержанию урока

**Procedure of the lesson:**

**Task 1. Translate the following word-combinations into Russian.**The input frequency, the transfer function, the gain, the frequency range, individual headings,
low-power applications, to crossover, a higher quiescent current, a subset.

 **Read and translate the text. Amplifier** Generally, an amplifier or simply amp, is any device that changes, usually increases, the
amplitude of a signal. The relationship of the input to the output of an amplifier—usually expressed
as a function of the input frequency—is called the transfer function of the amplifier, and the
magnitude of the transfer function is termed the gain.
 In popular use, the term usually refers to an electronic amplifier where the input "signal" is
usually voltage or current. In audio applications they are used to operate a loudspeaker that is being
used in a PA system to make the human voice louder or play recorded music. Amplifiers may be
classified by the input (source) they are designed to amplify (such as a guitar amplifier to perform
with an electric guitar), or named for the device they are intended to drive (such as a headphone
amplifier), or by the frequency range of the signals (Audio, IF, RF and VHF amplifiers for
example), or grouped by whether they invert the signal (inverting amplifiers and non-inverting
amplifiers), or by the types of device used in the amplification (valve or tube amplifiers, FET
amplifiers, etc.).
 A related device that emphasizes conversion of signals of one type to another (for example, a
light signal in photons to a DC signal in amperes) is a transducer, a transformer, or a sensor.
However, none of these amplify power.

**Power amplifier classes***Angle of flow or conduction angle.*
 Power amplifier circuits (output stages) are classified as A, B, AB and C for analog designs,
and class D and E for switching designs based upon the conduction angle or angle of flow, Θ, of the
input signal through the (or each) output amplifying device, that is, the portion of the input signal
cycle during which the amplifying device conducts. The image of the conduction angle is derived
from amplifying a sinusoidal signal. (If the device is always on, Θ = 360°.) The angle of flow is
closely related to the amplifier power efficiency. The various classes are introduced below,
followed by more detailed discussion under individual headings later on.

**Class A** 100% of the input signal is used (conduction angle Θ = 360° or 2π; i.e., the active element
remains conducting works in its "linear" range all of the time). Where efficiency is not a
consideration, most small signal linear amplifiers are designed as Class A. Class A amplifiers are
typically more linear and less complex than other types, but are very inefficient. This type of
amplifier is most commonly used in small-signal stages or for low-power applications (such as
driving headphones).

**Class B** 50% of the input signal is used (Θ = 180° or π; i.e., the active element works in its linear
range half of the time and is more or less turned off for the other half). In most Class B, there are
two output devices (or sets of output devices), each of which conducts alternately (push–pull) for
exactly 180° (or half cycle) of the input signal; selective RF amplifiers can also be implemented
using a single active element.
 These amplifiers are subject to crossover distortion if the transition from one active element to
the other is not perfect, as when two complementary transistors (i.e., one PNP, one NPN) are
connected as two emitter followers with their base and emitter terminals in common, requiring the
base voltage to slew across the region where both devices are turned off.

**Class AB** Here the two active elements conduct more than half of the time as a means to reduce the
cross-over distortions of Class B amplifiers. In the example of the complementary emitter followers
a bias network allows for more or less quiescent current thus providing an operating point
somewhere between Class A and Class B. Sometimes a figure is added (e.g., AB1 or AB2) with
higher figures implying a higher quiescent current and therefore more of the properties of Class A.

**Class D** These use switching to achieve a very high power efficiency (more than 90% in modern
designs). By allowing each output device to be either fully on or off, losses are minimized. The
analog output is created by pulse-width modulation; i.e., the active element is switched on for
shorter or longer intervals instead of modifying its resistor. There are more complicated switching
schemes like sigma-delta modulation, to improve some performance aspects like lower distortions
or better efficiency.

**Other classes** There are several other amplifier classes, although they are mainly variations of the previous
classes. For example, Class G and Class H amplifiers are marked by variation of the supply rails (in
discrete steps or in a continuous fashion, respectively) following the input signal. Wasted heat on
the output devices can be reduced as excess voltage is kept to a minimum. The amplifier that is fed
with these rails itself can be of any class. These kinds of amplifiers are more complex, and are
mainly used for specialized applications, such as very high-power units. Also, Class E and Class F
amplifiers are commonly described in literature for radio frequencies applications where efficiency
of the traditional classes in are important, yet several aspects not covered elsewhere deviate
substantially from their ideal values. These classes use harmonic tuning of their output networks to achieve higher efficiency and can be considered a subset of Class C due to their conduction angle
characteristics.

**Vocabulary:**

**to refer to** – относиться к
**headphone** – наушники
**the frequency range** – диапазон частоты
**to invert** – переворачивать, менять направление в обратную сторону
**to emphasize** – подчеркивать, придавать особое значение
**crossover distortion** – угрожающее искажение, пересекающееся искажение
**emitter** – излучатель, генератор излучения
**to slew** – поворачивать, вращать(ся)
**to be fully on (off**) – быть полностью включенным (выключенным)
**pulse-width modulation** – широтно-импульсная модуляция
**the supply rails** – питающие шины (шины питания)
**to deviate** – отклонять, менять направление

**Answer the questions:**
1. What is the function of an amplifier?
2. What is the relationship of the input o the output of an amplifier called?
3. How may amplifiers be classified by?
4. What are related device which emphasize conversion of signals of one type to another?
5. What do they differ in from an amplifier?
6. How are power amplifier circuits classified?
7. What angle is closely related to the amplifier power efficiency?
8. Explain in some words the power amplifier classes.
9. What are other amplifier classes?
10. What can you tell about the amplifier that is fed with the supply rails?

**Task 2. Define, what part of speech following words concern.**Generally, an amplifier, magnitude, amplify, whether, invert, conversion, several, although,
previous, variation, harmonic, efficiency, high.

**Task 3. Fill admissions with necessary prepositions.**1. Power amplifier circuits (output stages) are classified \_\_\_\_\_ A, B, AB and C \_\_\_\_\_ analog
designs, and class D \_\_\_\_\_ E \_\_\_\_\_ switching designs based \_\_\_\_\_ the conduction angle \_\_\_\_\_
angle of flow, Θ, of the input signal \_\_\_\_\_ the (or each) output amplifying device, that is, the
portion \_\_\_\_\_ the input signal cycle during which the amplifying device conducts.
2. These amplifiers are subject \_\_\_\_\_ crossover distortion if the transition \_\_\_\_\_ one active
element \_\_\_\_\_ the other is not perfect, as \_\_\_\_\_ two complementary transistors are connected as
two emitter followers \_\_\_\_\_ their base and emitter terminals \_\_\_\_\_ common, requiring the base
voltage to slew across the region \_\_\_\_\_ both devices are turned off.
3. These use switching to achieve a very high power efficiency. \_\_\_\_\_ allowing each output
device to be \_\_\_\_\_ fully on \_\_\_\_\_ off, losses are minimized. The analog output is created \_\_\_\_\_
pulse-width modulation; i.e., the active element is switched on \_\_\_\_\_ shorter or longer intervals
\_\_\_\_\_ modifying its resistor. There are more complicated switching schemes like sigma-delta
modulation, to improve some performance aspects like lower distortions \_\_\_\_\_ better efficiency.
4. Also, Class E and Class F amplifiers are commonly described \_\_\_\_\_ literature \_\_\_\_\_ radio
frequencies applications \_\_\_\_\_ efficiency \_\_\_\_\_ the traditional classes in are important, yet several
aspects not covered elsewhere.

**Task 4. Fill admissions by translating the word-combinations from Russian into English.**1. The relationship of the input to the output of an amplifier is called \_\_\_\_\_\_\_\_\_
(передаточная функция) of the amplifier, and the magnitude of the transfer function is termed
\_\_\_\_\_\_\_\_\_ (коэффициент усиления).
2. Amplifiers may be classified by \_\_\_\_\_\_\_\_ (источнику) they are designed to amplify or
named for the device\_\_\_\_\_\_\_\_\_\_\_ (которое они предназначены приводить в действие), or by
\_\_\_\_\_\_\_\_\_\_ (частотный диапазон) of the signals, or grouped by whether \_\_\_\_\_\_\_\_\_\_ (они
инвертируют (обращают) сигнал) (inverting amplifiers and non-inverting amplifiers), or
\_\_\_\_\_\_\_\_\_\_\_ (по типу приборов, используемых) in the amplification.

3. \_\_\_\_\_\_\_\_\_\_\_\_ (Усилители мощности цепей) (output stages) are classified as A, B, AB
and C for\_\_\_\_\_\_\_\_\_ (аналоговая конструкция), and class D and E for (конструкция
переключения).
4. Class A amplifiers are typically \_\_\_\_\_\_\_\_\_ (более линейные) and \_\_\_\_\_\_\_\_\_\_\_ (менее
сложные) than other types, but are very inefficient.
5. These amplifiers are subject to \_\_\_\_\_\_\_\_\_\_\_ (угрожающему искажению) if the
transition from one active element to the other is not perfect.
6. By allowing each output device to be either fully on or off, \_\_\_\_\_\_\_\_\_\_\_ (потери) are
minimized.
7. Class G and Class H amplifiers are marked by variation of \_\_\_\_\_\_\_\_\_\_\_ (питающие
шины) (in discrete steps or in a continuous fashion, respectively) following the input signal.
8. These classes use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (синусоидальную величину) of their output
networks to achieve higher efficiency.

**Task 5. Tell about various classes of amplifiers.**

**Task 6. Translate into English.**1.Измерительный усилитель — электронный усилитель, применяемый в процессе
измерений и обеспечивающий точную передачу электрического сигнала в заданном
масштабе.

2.Измерительные усилители применяются в качестве предварительных усилителей
слабых сигналов постоянного и переменного токов, а также в качестве выходных усилителей
мощности. Их чувствительность по току достигает значений 10-15 А, а по напряжению —
нескольких микровольт. Усилители, предназначены для повышения мощности источников
звукового и ультразвукового диапазонов, имеют выходную мощность 4 — 6 Вт.

3.Некоторые усилители имеют встроенные индикаторы уровня, позволяющие
определять значение входного сигнала.
4.Магнитным усилителем называется электромагнитное устройство, с помощью
которого слабый электрический сигнал (например, незначительное изменение э. д. с,
напряжения или тока) может быть преобразован в сигнал значительно большей мощности.

5.класс «A» — аналоговая обработка сигнала, линейный режим работы усилительного
элемента класс «AB» — аналоговая обработка сигнала, режим работы с большим углом отсечки (>90°).

класс «B» — аналоговая обработка сигнала, режим работы с углом отсечки равным 90°
класс «C» — аналоговая обработка сигнала, режим работы с малым углом отсечки (<90°)

класс «D» — аналоговая обработка сигнала, усилительный элемент работает в ключевом режиме, скважность импульсов изменяется в соответствии с текущим значением входного сигнала линейно, не имея дискретных значений, применяется широтно-импульсная модуляция, усилительный элемент работает в ключевом режиме.