

# E-Lecture-Presentation as an Important Element of Learning in Higher Education

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**Abstract**—The digital transformation of the economy and the information society affects all aspects of human activity, both in personal life and in professional and social activities. One of the important aspects of the ongoing global change is the transformation in education. This is a multi-factor problem concerning not only technical, technological solutions, but also major changes in the mental sphere. And here it is necessary to take into account the age of students, their readiness to use a variety of information and communication solutions in the organization of education, the availability of appropriate educational and methodological materials, and so on. Currently, there are a large number of examples of the implementation of infocommunication technologies in education at various levels. However, in this article we will focus on the consideration of what seems to be effective in learning at the higher education level. This allows expecting the appropriate level of competence of students in terms of their computer skills and readiness for self-mastering the discipline.

## I. INTRODUCTION

The basis for studying any course in a higher education institution is a textbook or educational-methodical materials replacing it, if the course is new and based on rapidly changing source content. It should be noted that the textbook is a sufficiently voluminous information resource used for a very long time, characterized by the fundamental presentation of the material, the necessary rigor and completeness.

Taking into account the actual time allocated for presentation of the course materials to students by the teacher, it is safe to say that the teacher can and should present the most important essential provisions of the course at lectures, leaving certain sections for independent study by students, as well as for study at practical and laboratory classes [1], [2], [3].

Thus, the basis of the course is a textbook, and the form of its presentation to students by the teacher is lectures.

Since the creation of a textbook, its writing and publication, take a very long time, it is the teacher's lectures are more mobile and adequate form of informing the students of up-to-date information on the course.

Without rejecting in general the possibility of presenting educational information by promptly reproducing it on a chalkboard, or a felt-tip pen, or a sticker on the screen, let us point out to the most efficient and thought-out presentation form, namely, the form of a PowerPoint presentation [4]. In

this case, the lecturer, depending on the course and the readiness of the students (learner) to self-instruction, should determine the method of recording what they set forth.

As studies show, the efficiency of memorization by students and the reproduction of educational information by them is higher if they record material and form an abstract of lectures, as compared with the case when the teacher gives them pre-prepared material. At the same time, the formation of the abstract of lectures by a student takes a certain time, the result of which is the "loss" in the speed of presenting the material. So, when preparing a presentation, the teacher should take into account the readiness of students to perceive information not only at lectures, but also when studying independently [5].

Based on the significant experience of teaching technical disciplines in higher education [6], it should be noted that there is a need for gradual control of the learning material mastering by students. For this purpose, the lecture-presentation, i.e. PowerPoint, has a built-in testing complex that can be used both in online and off-line modes [7], [8], [9].

Thus, the created electronic lecture-presentation (e-lecture-presentation) in PowerPoint with built-in testing complex corresponds to the task.

## II. THE STAGES OF DEVELOPMENT OF E-LECTURES-PRESENTATIONS

### A. Systems and standards of distance education

Currently, electronic education is widely used due to global development and the wide-spread use of various electronic devices: tablets, smartphones and other gadgets that allow you to receive distance learning.

Such an interest in electronic education is fully justified - learning takes place in a more comfortable and easy setting, and in some cases more efficiently than in classes organized in the usual "full-time schedule". The basis for e-learning is the creation of electronic educational content that allows accessing educational materials and gaining knowledge anytime, anywhere and on any device. Thus, the primary task is the creation of such electronic educational content.

The structure of electronic educational content includes:

- electronic textbooks, most fully covering all the studied material;

- electronic learning tutorials covering selected sections of the studied material;
- electronic educational-methodical guidance for seminars (practical classes) and student's independent work;
- electronic laboratory works and relevant recommendations for their implementation;
- testing systems for the course being studied with questions or tasks for the possibility of independent control of the learning material mastering;
- e-lecture-presentations, structured by sections and with built-in testing complex, etc.

The contents and quality of educational material in electronic educational content, unlike the Internet, where the necessary information is scattered across different sites and is not always checked for compliance with reality, corresponds to the educational program for the specified course. At the same time, unlike the usual written summary, which the student makes at the lecture, all the necessary educational material in the electronic educational content is arranged more informatively and methodically complete [10], [11].

To create e-learning systems, it is necessary that such systems meet the most important criteria, such as: the ability to install and operate on any hardware and software platform; support for English, as well as other languages of world importance, including Russian language; support of various international standards used in e-learning (SCORM, IMS / GLC); availability of security system; unambiguous and intuitive user interface; the possibility of expanding the functionality through the integration of external modules, as well as the organization of a score-rating system of assessments; availability of features that allow the development and editing of educational materials; the modularity of the educational material (all the material for a particular course is divided into blocks or parts corresponding to certain sections in this course, which will allow to use these blocks in the arrangement of other courses that are completely different from this one) allowing to reduce the development time of the education course because once created, the object can be reused over and over.

In addition to the most famous distance learning system – Moodle, as well as the Claroline LMS, Eliademy, Microsoft Learning Content Development System (LCDS), there are alternative paid and free distance learning systems on the Russian market: ATutor, Efront, JoomlaLMS, SharePoint LMS.

Moodle (Modular Object-Oriented Dynamic Learning Environment) is a freely distributed learning management system (LMS). Moodle allows you to create a huge number of educational elements and resources, so courses in Moodle are not just a set of lectures and tasks. The course in the Moodle system, created by an experienced teacher, looks like a structure of complementary elements that differ in their appearance and purpose. In addition to the standard elements of learning, such as lectures, tasks and tests, Moodle uses a glossary, wikis, blogs, forums and practical works that help diversify the learning process. It is worth noting a well-

developed communication system of Moodle. Moodle is translated into dozens of languages, including Russian, and is used in almost 50 thousand organizations from more than 200 countries of the world.

Claroline LMS is a platform based on an Open Source license for e-learning and electronic working (e-working). Claroline LMS is used in hundreds of organizations in 90 countries of the world. Claroline is a convenient tool that allows you to create different courses and manage the learning process and other activities of students, and monitor their progress. Management and learning do not require special tools, you only need a web browser (Mozilla, IE, Opera and others), the operating system does not play a role. Platform management and learning of the course do not require special technical skills from teachers and students. The program interface is translated into 35 languages, among which there is Russian language. It allows you to create and administer courses online. Each course contains a number of tools that enable the teacher:

- specify the course description;
- publish documents in any format (text, PDF, HTML, video ...);
- administer public and private forums;
- develop ways of learning;
- unite students into group;
- prepare for students online exercises (tasks);
- manage your agenda with tasks and deadlines;
- publish announcements (also by e-mail);
- post online information about current tasks;
- view user activity statistics;
- use wiki technology to co-write documents.

To share the content it uses the current SCORM (Sharable Content Object Reference Model) and IMS QTI (IMS Question and Test Interoperability specification) standards. This allows you to reuse courses in these formats.

Eliademy makes it easy and simple to create your own distance learning courses that can be used in educational activities. The service is translated into many languages, including Russian. The Eliademy project is and will remain free, and in the future, massive open online courses will be created on the basis of this platform.

Eliademy contains the most important parts for online learning: lecture materials, discussion forums, and individual tasks. It is possible to download notes through evernote.com (an online service and a number of applications for various platforms designed to save, synchronize and search for notes) and create events in the calendar. Using such a simple service as Eliademy, teachers can create small courses of 4–5 lessons on a specific topic, upload their presentations and other materials necessary for the preparation, as well as tests to evaluate the knowledge gained by students.

Microsoft Learning Content Development System (LCDS) is a free tool that allows members of the Microsoft learning and certification community to create high-quality, interactive online courses and presentations using the Microsoft Silverlight Learning Snack. By filling in the convenient forms,

LCDS allows you to easily generate materials with wide user settings, interactive tasks, questionnaires, games, test work, animated and demonstration videos, and other multimedia resources. LCDS allows the Microsoft learning and certification community to perform the following tasks:

- rapid development and delivery of relevant and useful educational materials;
- delivery of web page content conforming to the SCORM 1.2 standard; 2004 and supporting placement in a learning management system;
- upload or attach previously developed materials (LCDS supports files of various formats);
- select a variety of forms that allow the development of advanced e-learning materials and interactive components based on Silverlight;
- develop the course structure with the possibility of adjustment at any time;
- download sample courses (need to install LCDS);
- create offline interactive elements for inclusion in PowerPoint presentations or running from a website.

ATutor is a freely distributed web-based distance learning system that allows developing and providing online courses for students. The system is easy to install. It is possible to develop themes and include various add-ins. Teachers can quickly create and structure the content of educational material for on-line classes, as well as compose and export courses for later use in other projects. Students has an intuitive interface with available modules. The system provides interface translation into Russian language.

The Efront system is an open-source software. The system has an intuitive user interface. The system is translated into Russian language, and is freely distributed, there are also certain paid modules. The free version has the following main modules:

- forum;
- content management;
- testing;
- glossary;
- library files;
- Scorm 1.2 support;
- internal mail and chat;
- comments;
- custom reports, lesson reports, system reports, test reports.

JoomlaLMS is the system that integrates with an open-source software Joomla. It has the following advantages:

- simple and intuitive user interface and toolkit;
- multilingual interface: Russian, English, German, Spanish and others;
- the user's personal page, where you can also view information related to the distance education system – My courses, My notifications, My files, etc.;
- several levels of access and distributed administration of the educational process: administrator, teacher, assistant teacher, supervisor/parent, student.

SharePoint LMS is a distance learning system developed on the basis of Microsoft Office SharePoint Server and integrated with Microsoft Office Communication Server 2007 and Lync. Owing to this close connection with Microsoft products, the system perfectly supports most of the files that are supported by Microsoft Office, and also has a number of advantages associated with the excellent support of Microsoft programs:

- easy integration with Microsoft Office and Microsoft Office SharePoint;
- the use of communications tools based on Microsoft Office Communicator Server or Lync;
- creating an Active Directory for work;
- publication and editing of documents;
- locking and unlocking the documents (when editing);
- controlling the process of studying materials and testing students;
- obtaining and creating certificates on passing tests and educational materials;
- checking documents for plagiarism.

The most common standards of distance education systems recognized by the international standard of development in the field of e-learning are: SCORM and IMS / GLC. Standards contain requirements for the organization of educational material and distance learning system in general, allow for the compatibility of components and their reusability: the educational material is presented in separate small blocks that can be included in different educational courses and used by the distance learning system regardless of by whom, where and by what means they were created [12], [13].

The considered systems and standards of distance learning allow creating electronic educational content, which includes the various components listed above.

Let us dwell on the creation of one of the most important components of electronic educational content, namely the creation of e-lectures-presentations with built-in testing complex. The main advantage of such lectures-presentations is sufficient completeness of the material presented in a particular discipline with the possibility of introducing video and audio explanations, constant accessibility through the use of various electronic devices (computer, laptop, tablet, smartphone), the ability to quickly select any section for more in-depth study, and possibility of independent control of learning material mastering.

#### *B. The creation of e-lectures-presentations*

The basis of learning is a textbook – the result of the interaction of the most qualified and experienced teachers and researchers during meetings, discussions and considerations of various scientific problems, as well as on the basis of their scientific articles and monographs. Taking into consideration the existing multi-level education system in Russia, it is believed that a textbook at a high scientific level represents the description of the corresponding discipline.

On the basis of the textbook e-lectures-presentations are formed, reflecting what students can display in real-time in their

notes when studying the relevant discipline, based on the classroom hours and total amount of hours devoted to studying this subject according to the curriculum. E-lecture-presentations are used for a concentrated display of the discipline under study. In addition to the traditional presentation of material in the form of texts, graphs and formulas, it is advisable to use multimedia tools and game plots in them [14]. It is recommended to structure e-lecture-presentations into sections, which should be "equipped" with testing questions or tasks [15].

Thus, when creating an e-lecture-presentation, the teacher must carry out certain stages, shown in Fig. 1, namely:

- 1) Break the content of educational material (textbook) into fragments corresponding to certain sections of the discipline.
- 2) On the basis of the obtained fragments form an abstract of lectures using traditional or electronic media.
- 3) Determine for each fragment the key positions in the form of text, graphs, formulas, drawings, which will be placed on the slides of the lecture-presentation.

4) Create a script of the e-lecture-presentation and, on its basis, create slides of the lecture-presentation using the data from item 3.

5) Prepare a multimedia accompaniment for each slide, using audio and video explanations, as well as involving virtual characters that contribute to a better perception of the studied material by students.

6) Create a testing complex for the studied sections of the e-lecture-presentation based on the prepared questions and tasks.

7) Based on the data of items 4, 5 and 6 create a complete e-lecture presentation.

The first three stages of creating an e-lecture-presentation, as well as writing a script, are related to the teacher's professional activities, and are a preparatory stage, therefore, they are not considered in this article.

The fourth stage is to create slides for the e-lecture-presentation based on the materials that were obtained during the preparatory actions. Slides can be of varying difficulty. Consider this on the example of the Russian-language e-lecture-presentation on the course "Theory of information and coding".

The simplest and less time-consuming option is a slide with a consistent display of a text message. For example, what is studied in this discipline; definitions of various concepts used in the discipline; examples with leading questions; various statements and so on and so forth. Fig. 2 shows some of these slides.

The situation is somewhat more complicated when creating a slide with inserts of formulas, static or dynamic pictures, structural, schematic diagrams and graphs. Such slides require the creator to have certain skills in working with the editor of formulas, diagrams, various figures and ready-made drawings. Examples of such slides are shown in Fig. 3.

Another and the most difficult and time-consuming variant of a slide is a slide with changing image parameters. With the help of such slides, it becomes possible to explain a number of processes that could not be intelligibly explained using static images or graphs, as well as a text message.

**Теория информации**

- ЧТО ТАКОЕ ИНФОРМАЦИЯ?
- КАК ОНА ВОЗНИКАЕТ?
- КАК МЫ УЗНАЕМ ИНФОРМАЦИЮ?
- КАКИМИ ОНА ОБЛАДАЕТ СВОЙСТВАМИ?
- МОГУТ ЛИ ЖИВОТНЫЕ ВОСПРИНИМАТЬ ИНФОРМАЦИЮ?
- МОГУТ ЛИ КОМПЬЮТЕРЫ СОЗДАВАТЬ ИНФОРМАЦИЮ?
- .....??????????????

**Теория информации**

Отношение в теории множеств – математическая структура, которая формально определяет свойства различных объектов и их взаимосвязи. Распространёнными примерами отношений в математике являются равенство, делимость, подобие, параллельность и т.д. Наглядно теоретико-множественное отношение можно представить в виде таблицы, каждая строка которой содержит конкретные примеры объектов, связанных данным отношением.  
 Например, телефонный справочник можно рассматривать как отношение, отражающее связь между следующими объектами: *Телефон ↔ ФИО абонента ↔ Почтовый адрес ↔ ...*  
 Отношения обычно классифицируются по количеству связываемых объектов и собственным свойствам (симметричность, транзитивность и пр.).

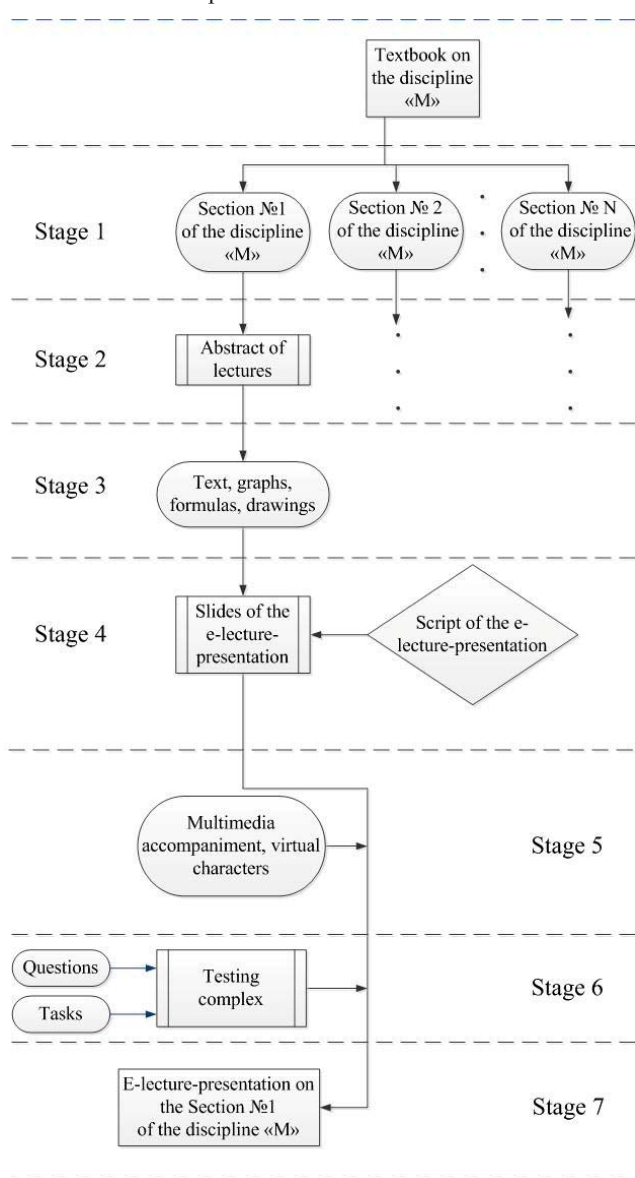


Fig. 1. Stages of creating an e-lecture-presentation

Fig. 2. Example of slides with a simple text message



Fig. 3. Example of slides with inserts of various formulas and drawing elements

For example, the process of analog-digital and digital-analog signal conversion, the process of operation of various coders, the process of forming the oscillogram on the screen and so on.

Creating such a slide is shown in Fig. 4 as an example of the inverse conversion of a digital signal into an original continuous signal – a digital-analog signal conversion.

Creating such slides requires a lot of experience in PowerPoint, but allows you to make the learning material much more understandable and accessible.

The next step in creating slides for an e-lecture-presentation is multimedia accompaniment for each slide using audio and video explanations, as well as involving virtual characters.

For a better perception of the studied material by the students, the slide can be voiced, which will significantly expand the information provided, and present relevant explanations or examples. Video explanation will allow to bring an e-lecture-presentation to the version of the lecture with the presence of a teacher. But we must remember that the addition of such multimedia accompaniment significantly increases the total size (volume) of the finished file, therefore the most accurate and compact presentation of the material is necessary for explanations. For example, the total volume of the e-lecture-presentation without voice explanation is 65 Megabyte for 300 slides. On average, the weight of each slide without soundtrack is 200 Kilobyte. The added voice explanation increases the volume of the entire presentation to about 320 Megabyte. And on average, the weight of one slide with voice explanation is already 1.1 Megabyte (~ 3 minutes duration) [16].

In addition, you need to know that not all audio and video formats are supported for embedding in PowerPoint. For video, the most universal formats are AVI or WMV files. If it is impossible to insert a sound or video file, it must be converted to the recommended format.

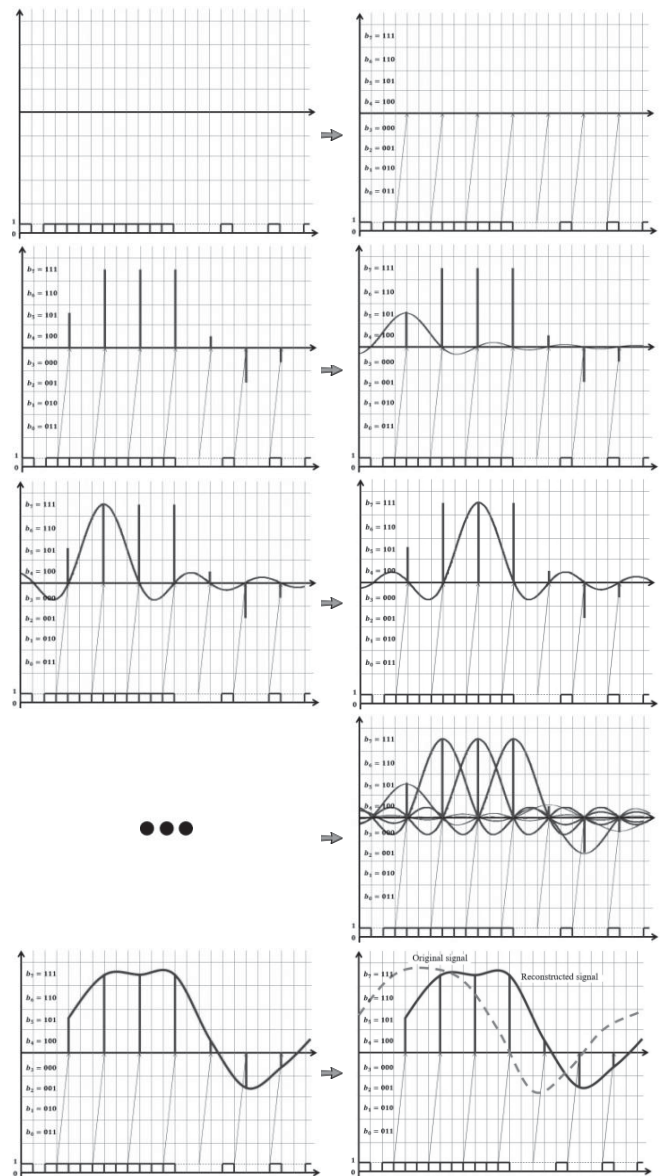


Fig. 4. Example of a slide with changing image parameters

As experience shows, the involvement of virtual characters (gif-animation) also helps to increase the interest of students to the e-lecture-presentation, which has a positive effect on the adoption of the studied material and subsequent control. Creating virtual characters is another most difficult and time-consuming stage, requiring skills to work with various video or photo editors. It is possible to install such editors as a special software product on a personal computer and use them in the off-line mode, or use on-line editors available on the Internet.

The sixth stage is the preparation of questions and the creation of a testing system. The preparation of test questions and tasks for the studied sections as the first stages is also the professional activity of the teacher, it can also be attributed to the preparatory stage, which is not considered in this article.

Creating a testing complex in PowerPoint based on the prepared test questions and tasks already requires the

professional skills of the programmer from the creator of the e-lecture-presentation. To do this, you must have the skills to work with Visual Basic for Application (VBA) – a somewhat simplified version of the Visual Basic programming language that is built into the Microsoft Office product line, as well as into many other software packages. VBA is a modern language of visual and object-oriented programming, which allows you to create your own objects and work with a huge number of objects contained in libraries [17]. It is necessary to remember that the applications (testing complex) created using VBA are a macro command, that is, a program algorithm of actions recorded by the user. This can be perceived as a security threat, since these applications are an external program component for office applications. Therefore, when saving an e-lecture-presentation with the presence of an application using the VBA language, you must select the appropriate format – .pptm, and also set the permissions in the "Trust Center" section by switching the "Enable all macros" option in the "Macro settings".

There are two possibilities in PowerPoint for creating a testing complex: using slides or special custom forms UserForm (some analogue of slides). In both cases, the created tests have almost the same parameters, but using UserForm you can achieve more safety and security of the entire testing complex.

When creating a testing complex, it is desirable to have various options for displaying test questions and tasks. The simplest and most well-known option is the choice of one or several correct answers, and the answers can change or not change their location upon subsequent entrance to the testing complex. Such variants of tests make it possible to reveal the lack of knowledge in the section as a whole, since they mainly contain questions covering the entire course. In addition, in order to remove the possibility of “memorizing” the correct answers, upon the subsequent entry into the testing complex a different interpretation both of the question and of the answers is possible. An example of such a display of questions is shown in Fig. 5.

The next option is the calculation and input or selection of the calculated value from the proposed options, which develops the students’ ability to use electronic educational material – to memorize and correctly apply the necessary formulas and graphs. Upon subsequent entry into the testing complex, it is possible to change the source data – numerical values. An example of such a display are the tests presented in Fig. 6.

Another option is to construct a logical chain of answers, as well as the task of establishing compliance, which allows developing logical thinking, which is required in many life situations, as well as in solving complex technical problems. Upon subsequent entry into the testing complex, it is possible to change the position of the task images, as well as other source data. Fig. 7 shows an example of the display of such tests.

The next option to display tests is the constructing of flowcharts, and making correct statements, which allow to develop flexibility and originality of thinking, to establish patterns.

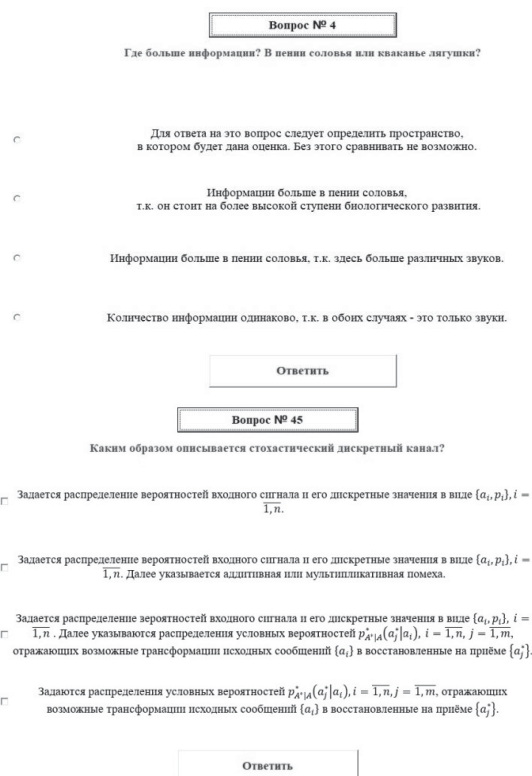


Fig. 5. Example of a test with the choice of one or several correct answers

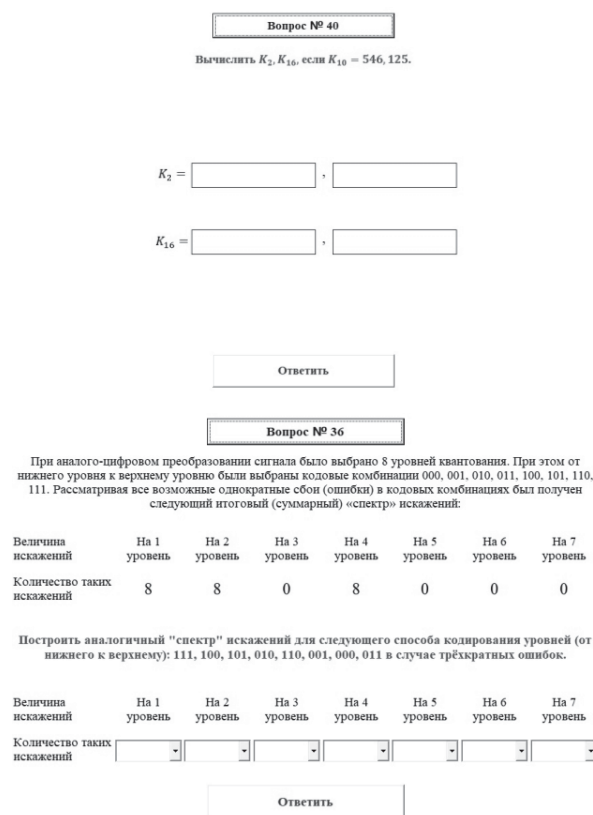


Fig. 6. Example of a test with the calculation and input or selection of the calculated number from the proposed options

**Вопрос № 14**

Для некоторого сверточного кода задана решетчатая диаграмма. Для поступающей от источника кодовой комбинации  $\{u_i\} = (11010)$ , считая слева направо, т.е. первыми на кодер поступают две «1», затем «0», потом «1» и снова «0», построить на приведенной ниже решетчатой диаграмме путь, указав на каждом из этапов на  $I$ , на  $II$ , ..., на  $V$  и на  $VI$  номера узлов, т.е. либо 00, либо 01, либо 10, либо 11. На первом этапе  $I - 00$ . Указать кодовую комбинацию на выходе декодера  $\{v_j\}$ .

**Решетчатая диаграмма**

Вход	Выход
00	00 - 0-00 = 000: 1-00 = 100
01	01 - 0-01 = 001: 1-01 = 101
10	10 - 0-10 = 010: 1-10 = 110
11	11 - 0-11 = 011: 1-11 = 111

0 - красный цвет, 1 - синий цвет.

$I - \square, II - \square, III - \square, IV - \square, V - \square, VI - \square$   
 $\{v_j\} = \square\square\square\square\square\square$

**Ответить**

**Вопрос № 41**

Установите соответствие между изображениями АЧХ фильтров и их названиями: № АЧХ фильтра - № названия фильтра.

1  Полосовой фильтр.

2  Фильтр нижних частот.

3  Режекторный фильтр.

4  Фильтр верхних частот.

**Ответить**

Fig. 7. Example of a test with construction of a logical chain of answers and establishing compliance

Upon subsequent entry into the testing complex, it is possible to change the initial position of the source data used to construct flowcharts or statements. Fig. 8 shows an example of the display of such tests.

Another option is the construction of formulas from the source data, which develops the ability of students to memorize complex formulas (which is useful for further mastering of the course) and special attention, since it is necessary to make an expression in a clearly defined order, taking into account all the necessary signs: multiplication, division, summation, subtraction. Upon subsequent entry into the testing complex, it is possible to change the initial position of the source data used to construct the formula. Fig. 9 shows an example of the display of such tests.

In addition, it is possible to create tests combining several options of the display discussed above. An example of the display of such test is shown in Fig. 10.

When implementing a testing complex, it is possible to clock the answers, take into account the amount of erroneous answers, and based on these results, display a report that reflects the time spent on executing tests, the total amount of questions asked, the amount of erroneous answers, and numbers (or task text) of those questions where mistakes are made. Such a report will allow students to draw attention to the existing gaps in their knowledge and to pay more attention to re-studying exactly the educational section where mistakes were made. The report can be displayed on the screen, printed or saved to a file.

**Вопрос № 1**

Соберите блок-схему системы связи, выбрав соответствующие номера из приведенных ниже названий блоков синего цвета и разместив их в соответствующие квадраты синего цвета. Выберите соответствующие номера из приведенных ниже условных обозначений сообщений и сигналов красного цвета и разместите их в соответствующие квадраты красного цвета. Укажите направление взаимодействия блоков, выбрав соответствующие стрелки.

1. Получатель сообщений
2. Линия связи
3. Источник помех
4. Приемник
5. Источник сообщений
6. Передатчик
7.  $a(t)$
8.  $\alpha^*(t)$
9.  $\xi(t)$
10.  $s(t)$
11.  $s^*(t)$

**Ответить**

**Вопрос № 30**

Составьте правильные утверждения, поставив соответствующие номера.

Пара преобразований  устанавливает связь между  и , а пара преобразований  устанавливает связь между  и . При этом верны следующие соотношения  и .

1. Парой преобразований  устанавливает связь между  и  функцией корреляции сигнала
2. спектральным представлением сигнала
3. СПМ сигнала
4. Фурье
5. Винера-Хинчина
6. временным представлением сигнала

7.  $G_x(\omega) = \int_{-\infty}^{\infty} B_x(\tau)e^{j\omega\tau}d\tau, B_x(\tau) = \frac{1}{2\pi} \int_{-\infty}^{\infty} G_x(\omega)e^{-j\omega\tau}d\omega$
8.  $S_{x,r}(j\omega) = \int_{-\infty}^{\infty} x_r(t)e^{-j\omega t}dt; x_r(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} S_{x,r}(j\omega)e^{j\omega t}d\omega$
9.  $G_x(\omega) = \int_{-\infty}^{\infty} B_x(\tau)e^{-j\omega\tau}d\tau, B_x(\tau) = \frac{1}{2\pi} \int_{-\infty}^{\infty} G_x(\omega)e^{j\omega\tau}d\omega$
10.  $S_{x,r}(j\omega) = \int_{-\infty}^{\infty} x_r(t)e^{j\omega t}dt; x_r(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} S_{x,r}(j\omega)e^{-j\omega t}d\omega$
11.  $S_{x,r}(j\omega) = \int_{-\infty}^{\infty} x_r(t)e^{j\omega t}dt; x_r(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} S_{x,r}(j\omega)e^{j\omega t}d\omega$
12.  $G_x(\omega) = \int_{-\infty}^{\infty} B_x(\tau)e^{j\omega\tau}d\tau; B_x(\tau) = \frac{1}{2\pi} \int_{-\infty}^{\infty} G_x(\omega)e^{j\omega\tau}d\omega$

**Ответить**

Fig. 8. Example of a test with the construction of a flowchart and the correct statement

**Вопрос № 62**

Запишите выражение для АМ ( $S_{AM}$ ), когда модулирующим сигналом  $x(t)$  является соответствующие номера из приведенных ниже составляющих и разместив их в представленные ниже квадраты, расставив все необходимые знаки умножения, деления, суммирования, вычитания.

1	$S_{AM}$	12	$m_{AM}$
2	+	13	cos
3	$x(t)$	14	$x(t)$
4	$\int_0^t$	15	.
5	1	16	+
6	-	17	$\omega_0 \cdot t$
7	$\omega_{max}$	18	$\varphi_0$
8	$U_m$	19	$S_{ФМ}$
9	$m_{ФМ}$	20	$\varphi_{max}$
10	$dt$	21	$S_{ЧМ}$
11	$\omega_c$	22	$\omega_0$

=  (   )  (  )

**Ответить**

**Вопрос № 65**

Запишите выражение для АМ ( $S_{AM}$ ), когда модулирующим сигналом  $x(t)$  является гармоническое колебание  $\cos \Omega \cdot t$ , выбрав соответствующие номера из приведенных ниже составляющих и разместив их в представленные ниже квадраты, расставив все необходимые знаки умножения, деления, суммирования, вычитания.

Продолжите дальше осуществлять преобразование, положив  $\varphi_0 = 0$ .

1	-	12	$m_{AM}$
2	$S_{AM}$	13	$x(t)$
3	$\varphi_{max}$	14	4
4	+	15	+
5	$U_m$	16	$\Omega \cdot t$
6	$t$	17	$\omega_0 \cdot t$
7	1	18	$\varphi_0$
8	$\omega_{max}$	19	$\Omega$
9	2	20	3
10	.	21	cos
11	$\omega_c$	22	$\omega_0$

=  (   )  (  ) =   +   (  )  +   (  )  +   (  )

**Ответить**

Fig. 9. Example of a test with the construction of formulas from the source data

**Вопрос № 11**

Привести порождающую матрицу  $G = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$  к каноническому виду.  
 Построить проверочную матрицу и вычислить синдром при  $e_1 = (110011), e_2 = (100101), e_3 = (111100)$ .

Канонический вид:  $G = \begin{pmatrix} \square & \square & \square & \square & \square & \square \\ \square & \square & \square & \square & \square & \square \\ \square & \square & \square & \square & \square & \square \end{pmatrix}$

Проверочная матрица:  $H = \begin{pmatrix} \square & \square & \square & \square & \square & \square \\ \square & \square & \square & \square & \square & \square \\ \square & \square & \square & \square & \square & \square \end{pmatrix}$

$s_1 = (\square \ \square \ \square) \quad s_2 = (\square \ \square \ \square) \quad s_3 = (\square \ \square \ \square)$

$e_1 - \text{[dropdown]} \quad e_2 - \text{[dropdown]}$   
 $e_3 - \text{[dropdown]}$

**Ответить**

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**Вопрос № 6**

Источник: создает 16 возможных сообщений. Для их однозначного кодирования с помощью двоичного кода необходимо и достаточно использовать двоичную комбинацию из  $k = 4$  двоичных символов. Применим для повышения помехоустойчивости итерированный код с двумя проверками на чётность. При этом рассмотрим две конструкции кода по размещению  $k$ -символьной кодовой комбинации. Например, комбинация 1011 из  $k$  символов в первом варианте имеет вид:  $\begin{pmatrix} 1 & 0 & 1 & 1 \\ \square & \square & \square & \square \end{pmatrix}$  и во втором варианте:  $\begin{pmatrix} 1 & 0 & \square & \square \\ \square & \square & \square & \square \end{pmatrix}$ , где пустые места в приведенных таблицах (матрицах) соответствуют проверочным разрядам итерированного кода с проверкой на чётность. Необходимо заполнить пустые места в таблицах (матрицах).

Как соотносится между собой значения  $d_{\min 1}$  первого варианта и  $d_{\min 2}$  второго варианта?

Какова гарантированная кратность обнаруживаемых ошибок в первом варианте  $q_{\text{обн}1}$  и во втором  $q_{\text{обн}2}$ ?

Какой вариант предпочтительней, т.к. обладает меньшей избыточностью?

$d_{\min 1} = d_{\min 2}$    $q_{\text{обн}1} = \square \quad q_{\text{обн}2} = \square$   
  $d_{\min 1} < d_{\min 2}$    $q_{\text{обн}1} < q_{\text{обн}2}$   
  $d_{\min 1} \leq d_{\min 2}$    $q_{\text{обн}1} \leq q_{\text{обн}2}$   
  $d_{\min 1} \geq d_{\min 2}$    $q_{\text{обн}1} \geq q_{\text{обн}2}$   
  $d_{\min 1} > d_{\min 2}$    $q_{\text{обн}1} > q_{\text{обн}2}$

второй вариант  первый вариант

**Ответить**

Fig. 10. Example of a test that combines several options of the display

The seventh and final stage is the integration of all previous parts into a single e-lecture-presentation.

### III. CONCLUSION

The study demonstrated constructive ways to create e-lectures-presentations, supplemented by a testing complex based on widespread software products. In addition, the solutions were proposed that provide audio support for the lecture material, which contributes to a better perception by students in their independent work and repetition of what was considered in the lectures during the classes with a teacher.

There are also various options for creating tests that form not only formal skills of memorizing correct answers for students, but also the ability to reason and search for the right logical solutions.

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