# UNIVERSAL LECTURE MATERIAL: DIGITAL TECHNOLOGY OF CREATION AND AUTOMATIC MODIFICATION

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## Abstract

*The automated technology of the conversion of various materials that are used by a teacher in their activity, into the uniformly issued electronic and further printing (paper) forms is offered. The technology is based on standards and requirements to digital prepress of the book edition, allowing to obtain the first-rate quality of the polygraphic press. The basic text of lectures and static graphic components, and also the dynamic graphic components in aggregate named the lecture material, it is necessary to unite in a breadboard model (layout) of lectures. The imposition is carried out by means of program complex InDesign of Adobe Systems Inc. The text is typed by vector fonts of Adobe Type 1 format. All static graphic components, except for photos, are created in EPS vector format. These formats provide the greatest possible smoothness of lines of symbols and drawings at any degree of increase/reduction. Two basic forms of representation of the lecture material are distinguished: for the press on paper and for demonstration on the audience screen – slide-show. For the purpose of uniform design of lectures they are combined in a book for the subsequent press in printing house or on an office printer. The book layout serves the base and the most difficult in technical aspect as the form of representation of the lecture material. By means of scripts in JavaScript language of scenarios it can be completely automatically practically obtained each chapter-lecture in the form of slide-show from the book layout. The basic software for creation of formulas, drawings, diagrams and ways of elimination of program defects are described.*
**Keywords***: digital prepress, lecture material, book, slide-show, eps, MathType, Adobe InDesign, Java Script.*

## Introduction

Teachers of high schools and colleges, the teacher of high schools while preparation for lectures, seminars, practical training use various sources of the information: printing editions, electronic materials, for example, from the Internet source. During the process of preparation for lessons carrying out the teacher makes lectures which include citations from books and scientific articles, reviews, data of patents, formulations of base concepts (definition). The text said by the lecturer, as a rule, is accompanied by demonstration of formulas, schemes, diagrams, that is static graphic material. Last years in educational process there are widely used animations, three-dimensional models, various video recordings — the dynamic graphic material which can be accompanied by a sound (audio records) (Frankowicz, 2006;

Shishonok, Rutsky, Makarenko and Krul, 2006; Shishonok, 2007). The interactive graphic material is besides, developed, which allows the user (to the pupil, to the student) to make operatively changes into the image directly during of its playback that is to operate on image contents, its form, the size and color on the screen by means of interactive controls (Lamanauskas, 2008). Texts of lectures and also accompanying their graphic and interactive materials in aggregate represent the multimedia lecture material.

The work of a teacher with course programs and abstracts of the lectures lasts throughout all years of its pedagogical activity. As a result the part of texts remains hand-written, the part – typed in computer editors with various styles of design. The same thing concerns the graphic material: the part of drawings can be stored drawn again from the primary source on a paper, the other illustrations are scanned or drawn in various programs of computer drawing. Still 10 years ago and earlier such heterogeneous condition of elements of the lecture material was natural: the lecture text was transferred by speech of the teacher, key formulas and schemes were drawn on slate board or displayed on screens of an educational audience through a projector in which the paper or a film with the drawing put on it was put. The wide prevalence of personal computers has led to sharp improvement of quality of a visual teaching material. There have been the possibility and the crying need to convert all available lecture materials into the electronic form, and, at uniformity of representation of texts and graphics. As to publication of the lecture material in uncontrollable space of electronic texts there is no yet the institute of the scientific reviewing and protection of copyrights. Hence, the edition of lecture materials in the form of the printing textbook as the book is comfortable for reading in any conditions is expedient.

In the present article the algorithm of creation of the universal lecture material in electronic form, approved on the concrete example of the general course of lectures «Chemistry of high-molecular compounds» is in details considered. Namely this problem has arisen before authors when there occurred the necessity to publish the course of lectures in the form of the printing textbook and scientifically-methodical articles, and also to conduct lectures, leaning on slide-show of the text, formulas, illustrations and animations. Initial data were texts, formulas, schemes and the graphs written either drawn by hand or typed on a typewriter for 25 years of pedagogical activity at chemical faculty of the Belarusian State University.

So, the purpose – working out of principles of creation of the universal lecture material which can be presented and as the layout for the press and as slide-show.

Problems:

1. to convert all text and graphic materials of lectures into an electronic representation;
2. to impose text and graphic materials of each chapter into the uniform layout for the press;
3. to create heading pages for each section of the book in which the name of section and the name of its chapters are specified;
4. to group all heading pages of sections and all chapters in the uniform book (through numbering of pages, drawings, formulas);
5. to create the book maintenance, indexes, lists of basic formulas, lists of definitions, drawings and tables;
6. to convert each chapter of the book into the form of lecture slide display.

## Results of Research

All above listed problems are carried out by us by means of the maximum automation with the aid of scripts in Java language in *InDesign* program.

The most comprehensive problem from the technical point of view is the creation of a typographical layout of the book as the imposition demands performance of some typing rules. Slide-shows for each lecture are automatically generated from representations for the press in two stages.

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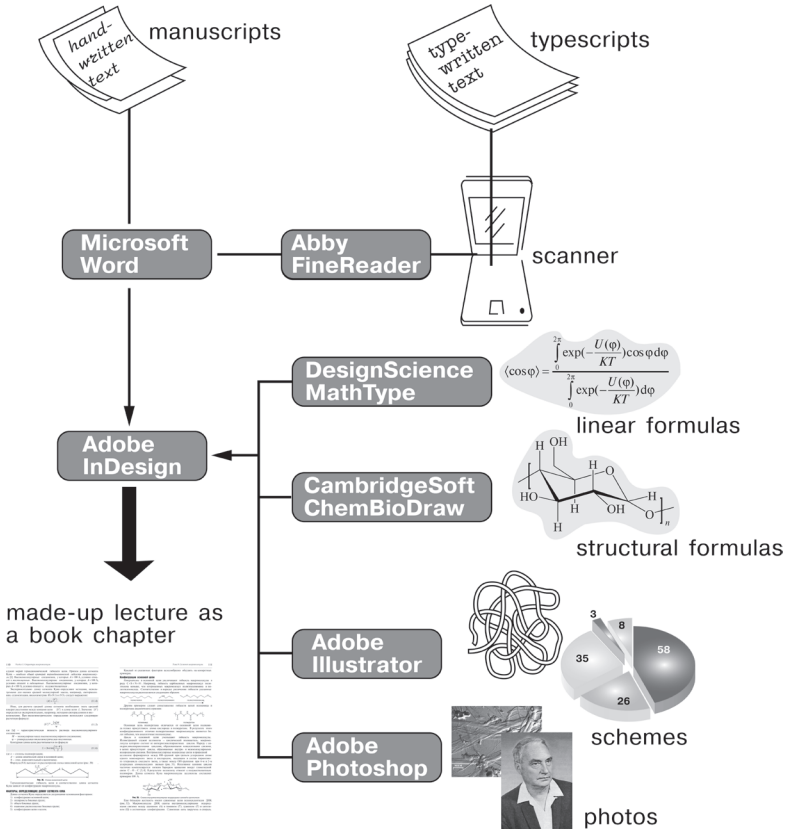


**Figure 1.** **The scheme of the processing of the universal lecture material components.**

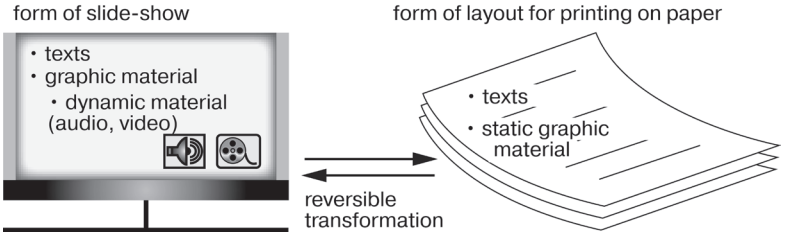


**Figure 2.** **Reversible transformation lectures' representation.**

***Texts*** are typed (or are scanned and distinguished by means of program *Abbyy FineReader*) in program *Microsoft Office Word*: this editor has most a powerful tool of spelling and syntax of various languages and allows to use autoreplacement of words. Further texts were placed into *InDesign* (Figure 1).

***Linear formulas*** (mathematical, physical, linear chemical) are typed in editor *Design Science MathType 6.5c* and kept in EPS format in text coding ASCII (at saving it is necessary to choose file type 'Encapsulated PostScript/none') (Figure 1). The text eps-file allows to add comment strings of the formula description that is necessary for automatic generation of the list of the basic mathematical formulas of the book after its creation. *MathType* co-operates with *Word* by means of a set of macros, and that allows to type formulas in *Word* simultaneously with the text, and then to export them into eps. All formulas should be typed in one style for what it is necessary to use Equation Preferences — a set of strictly set parameters of fonts and intervals between formula elements. Unfortunately, *MathType* has no tool of package formatting of the catalogue of formulas for giving to all formulas of one style; to open all formulas one by one and to apply to everyone certain parameters — rather labor-consuming and long procedure. Really, if the book contains, for example, one thousand formulas and there is a necessity to reduce a font size of formulas on 2 points at skill on one formula it is spent nearby 20 with, and on one thousand — about 350 minutes For realization of package formatting we had been created the program

with the aid of means *AutoHotKey* and *WinspectorSpy* which is started from the catalogue with formulas *MathType* and, consistently opening everyone, applies to it the set parameters and keeps it. In *MathType* any version up to *6.5c* inclusive there is the error which does not allow generally it is correct to deduce in PostScript the generated formulas from *InDesign*. For the decision of this problem it is necessary to open the mathtype.exe file in the hex-editor (for example, *WinHex*) to find an ASCII-fragment '/ns {cf sf} bdef' and to replace a symbol 'b' with a space. The Cyrillic text typed in *MathType* from the keyboard, is displayed in *InDesign* and printed incorrectly. For the solution of this problem it is necessary to copy in a folder …\Program Files\MathType\Fonts the file *cyrfont.enc* (the file of the coding for Cyrillics from company Adobe) and to bring in the file being in the same place *fontinfo.ini* following editings:

- in section [Encoding] to add a line 'Cyrfont = cyrfont.enc';
- in the file end fontinfo.ini to add kind lines '[Font1]'/'Name = NewtonC'/'Encoding = Cyrfont' for each Cyrillic font used in *MathType* (details are described in the file *fontinfo.ini*).

***Structural chemical formulas*** are created in editor *CambridgeSoft ChemBioDraw 11* (Figure 1).

***Schemes*** of various processes are drawn in program *Adobe Illustrator* (Figure 1). Schedules of numerical dependences and the diagram are constructed in such mathematical packages as *MatLab*, *MathCAD*, *Origin Pro* and then are artistically processed in *Adobe Illustrator*. Format EPS is solely "native" for *Adobe Illustrator* and provides the greatest possible smoothness of lines of symbols and drawings at any degree of increase/reduction.

***Photos*** of researchers, optical and electronic microphotographs are processed in program *Adobe Photoshop* (Figure 1).

All text and graphic material are imposed, and taking into account that each lecture can be in two forms: ***the layout for the printing on paper*** and ***slide-show*** for demonstration on the screen in an audience (Fig. 2). Most widely applied program of imposition is *Word* which is comprehensible to creation of the abstract of lectures and its press on office printer. However *Word* has a number of the essential lacks, not allowing to get a typographical layout:

- absence of possibility of work with vector Type 1 (PostScript) fonts;
- absence of possibility to introduce in the text the vector graphic material in EPS format;
- badly developed mechanism of automation of imposition.

Not less important cause of the refusal from *Word* as basic editor of a lecture material was the impossibility of full-fledged transfer of lectures from representation for the press into the representation of slide-show which dictates necessity to increase separate formulas, drawings or text fragments (for example, definitions) on full screen. In other words, *Word* it is not suitable for work with difficult volume text and graphic materials. Thereupon by the basic program environment for work with a lecture material, that is its imposition and transfer from one representation in another, has been chosen *Adobe InDesign* – the unique editor that absolutely correctly packs texts and the graphic material in EPS format (Padova, 2007). This format is the core one for the vector drawing which all graphic material concerns, except for photos (the raster images) both audio-and video data (the dynamic material). *InDesign* it is completely operated by means of *Java*, therefore the decision of all typical problems of imposition can be automated by means of the scripts written in Java language (Padova, 2007). Besides, *InDesign* allows to work with a set of lectures as with the uniform book.

For the purpose of conversion of the layout for the press into slide-show, first, it is necessary to change width, height and margins of pages of the initial document for the press to values which allow, not changing the sizes of fonts of the text to show lecture on the screen in an audience. Actually, this placing of a text and graphic material of invariable volume on большем number of pages of the smaller area. Thus graphic objects are proportionally reduced automatically if their height or width exceeds working area of a slide; the lecture heading (book chapter) is taken out on a separate first slide. For comfortable visual perception of lecture the soft background is given slides. Secondly, for each graphic object and definition of some concept the additional slide with the copy of this object as much as possible increased within working area of a slide is created. Between each such object and its increased copy inverse references are created. The obtained file is exported to format PDF. Between the first and second stage manual

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completion of the layout of slide-show as some slides received automatically are better for breaking into two more often is required or to "tighten" the text that the slide for two-three lines was not formed.

At the creation of the universal lecture material it is necessary to give special attention to computer fonts as to the main mean of delivery of the text information. The basic errors and failures at printing are caused by "wrong" fonts. On modern personal computers two formats of digital vector fonts prevail: Type 1 of Adobe Systems and TrueType from Microsoft. Using of TrueType-fonts is a little bit easier (for example, does not demand installation of special programs as their support is built in *Windows*), and fonts are more prevalent and more cheaply, than Type 1. In our case when materials taking into account possibility of their publication in polygraphic quality are prepared (and, hence, by means of the phototypesetting device working on PostScript), advantage Type 1 fonts is conclusive. Language of the description of pages PostScript is native for phototypesetting automatic machines and other printers with the high resolution, therefore PostScript-fonts are traditionally applied in publishing. For work with PostScript-fonts in operational system *Windows* it is necessary to install program *Adobe Type Manager*. It is possible to attach new fonts, to sort them and to choose, what are necessary at present for use and what are not present. Fonts Type 1 consist of two files: a file of PostScript-tracings .pfb and a file of metrics of a font. Files of metrics can be text (.afm) and binary (.pfm). *Adobe Type Manager* uses the binary format; .afm-files are usually applied in operational systems of family *Unix*, and also under *Windows* in the separate appendices having own mechanism of work with fonts Type 1.

## Conclusions

1. The algorithm of creation of the universal lecture material is developed, allowing simultaneously to make out and a typographical layout of the textbook, and slide-show of lectures.
2. Peak efficiency of use of software products of company Adobe Systems is proved.
3. The package of Java-scripts which provide automation of routine actions within the limits of work with separate appendices Adobe and their interactions is created.
4. Additional applied programs for correction of incorrectly generated code EPS by such programs, as *MathType* and *ChemBioDraw* are developed.
5. The offered approach is successfully approved at the edition of the textbook of M.V. Shishonok and L.P. Krul «Principles of chemistry of high-molecular compounds» (Shishonok, 2010) and reading of the general lecture course «Chemistry of high-molecular compounds» to students of chemical faculty of the Belarusian State University.

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