Хмельницький національний університет

WEB TECHNOLOGIES // ВЕБТЕХНОЛОГІЇ

Методичні рекомендації до виконання курсового проєкту здобувачами першого (бакалаврського) рівня вищої освіти спеціальності 121 «Інженерія програмного забезпечення»

Затверджено на засіданні кафедри інженерії програмного забезпечення. Протокол № 4 від 12.12.2023

Хмельницький 2024

Web technologies : methodical instructions for a course project for students of the first (bachelor's) level of higher education, programme subject area 121 “Software Engineering” = Вебтехнології : методичні рекомендації до виконання курсового проєкту здобувачами першого (бакалаврського) рівня вищої освіти спеціальності 121 «Інженерія програмного забезпечення» / О. М. Яшина, В. В. Мартинюк. Хмельницький : ХНУ, 2024. 56 с. (англ., укр.).

Укладачі: Яшина О. М., канд. техн. наук, доц.
Мартинюк В. В., д-р техн. наук, проф.

Відповідальний
за випуск: Бедратюк Л. П., д-р фіз.-мат. наук, проф.

Випусковий редактор: Яремчук В. С.

Технічне редагування і верстка: Чопенко О. В.

Макетування та друк здійснено редакційно-видавничим відділом Хмельницького національного університету (м. Хмельницький, вул. Інститутська, 7/1). Підп. до друку 31.01.2024. Зам. № 3/24, тир. 50 прим., 2024.

ХНУ, 2024

ВСТУП

Дисципліна «Вебтехнології» відноситься до обов'язкових освітніх компонентів у підготовці здобувачів першого бакалаврського рівня, які навчаються за освітньо-професійними програмами в межах спеціальності 121 «Інженерія програмного забезпечення». Курсовий проєкт представляє собою вид самостійної навчальної роботи та контролю якості навчання здобувача на певних етапах виконання навчального плану.

Мета курсового проєкту – систематизація, закріплення та розширення теоретичних знань і формування практичних навичок з розроблення програмного забезпечення з використанням фундаментальних концепцій, парадигм та основних принципів функціонування засобів інженерії програмного забезпечення за відповідною методологією.

Завдання курсового проєкту – підвищити рівень знань здобувачів в області інформаційних технологій, допомогти їм у формуванні творчого мислення, сформувати у здобувачів основні принципи застосування системного підходу до розробки веборієнтованого програмного забезпечення (ПЗ), а також відомих фреймворків та шаблонів проєктування при необхідності; набуття навичок розроблення та створення відповідної супровідної документації для створеного ПЗ; озброїти їх універсальним інструментарієм об'єктно-орієнтованого програмування (ООП), наприклад, у середовищі Microsoft Visual Studio тощо.

Виконання курсового проєкту сприяє поглибленню та розширенню загальних і професійних ***компетентностей*** та ***програмних результатів навчання***, зокрема: здатність застосовувати знання у практичних ситуаціях; здатність дотримуватися специфікацій, стандартів, правил і рекомендацій в професійній галузі при реалізації процесів життєвого циклу; здатність обґрунтовано обирати та освоювати інструментарій з розробки та супроводження програмного забезпечення; аналізувати, цілеспрямовано шукати і вибирати необхідні для вирішення професійних завдань інформаційно-довідникові ресурси і знання з урахуванням сучасних досягнень науки і техніки; уміння вибирати та використовувати відповідну задачі методологію створення програмного забезпечення; знати і застосовувати на практиці фундаментальні концепції, парадигми і основні принципи функціонування мовних, інструментальних і обчислювальних засобів інженерії програмного забезпечення; мотивовано обирати мови програмування та технології розробки для розв'язання завдань створення і супроводження програмного забезпечення.

Керівництво курсовим проєктом з дисципліни здійснює викладач кафедри. Захист проєкту відбувається відповідно до графіка курсового проєктування перед комісією, створеною завідувачем кафедри у складі двох–трьох викладачів кафедри, що здійснюють викладання дисциплін, пов'язаних з вебпрограмуванням.

Здобувач як автор проєкту несе повну відповідальність за прийняті рішення в курсовому проєкті, а також правильний вибір потрібних технологій, використання стандартів тощо.

Загальні методичні поради. Оформлення курсового проєкту має бути здійснено відповідно до нормативних документів. Однак, оскільки постійно здійснюється оновлення та вдосконалення чинних стандартів, то деякі положення висвітлені у методичних рекомендаціях (наприклад, оформлення літературного запису) можуть втратити свою актуальність. У таких випадках слід звертатися до періодичних видань, де публікуються зміни стандартів.

Основні вимоги, які висуваються до змісту проєкту: цільова направленість; чіткість побудови та логічна послідовність викладу матеріалу; глибина дослідження і повнота висвітлення матеріалу; переконливість аргументацій; лаконічність та точність формулювань; конкретне викладення результатів роботи і доказовість висновків та обгрунтованість рекомендацій; відповідність розробленого проєкту до поставлених вимог та технічному завданню; чітке і правильне проєктування й реалізація всіх модулів проєкту; його валідність.

Оцінювання курсового проєкту здійснюється за інституційною чотирибальною шкалою: «відмінно», «добре», «задовільно», «незадовільно» і шкалою ЄКТС (A, B, C, Д, E).

Оцінку «***відмінно***» здобувач отримує у разі, коли він виконав КП у повному обсязі без зауважень керівника і рецензента, з дотриманням всіх вимог, а при захисті показав: грамотний, логічний виклад доповіді, вірні і повні відповіді на питання (у т. ч. нестандартні); глибоке і повне опанування змісту навчального матеріалу; уміння пов'язувати теорію з практикою, обгрунтовувати свої судження, робити висновки; володіння різносторонніми навичками, прийомами і компетентностями.

Оцінка «***добре***» виставляється здобувачу у випадку, коли він виконав КП у повному обсязі, з дотриманням вимог, а при захисті демонструє тверде знання матеріалу роботи, грамотно і по суті викладає його, не допускає суттєвих неточностей у відповідях на питання, правильно застосовує теоретичні положення при вирішенні практичних завдань, володіє необхідними навичками і прийомами їх виконання.

Оцінки «***задовільно***» заслуговує здобувач, який виконав КП згідно із завданням, але припустився неточностей при його виконанні; при захисті виявив знання основного навчального матеріалу в обсязі, необхідному для професійної діяльності; засвоїв і набув практичних навичок у галузі, в основному справляється з виконанням практичних завдань, але допускає порушення логічної послідовності у викладенні матеріалу, помилки у відповідях на питання, відчуває труднощі при відповідях на видозмінені запитання.

Оцінка «***незадовільно***» виставляється у випадку, коли здобувач неякісно виконав курсовий проект, а при захисті показав безсистемні знання, не вміє виділяти головне і другорядне, припускається помилок у визначенні понять, перекручує їх зміст, хаотично і невпевнено викладає матеріал, не може використовувати знання при вирішенні практичних завдань.

INTRODUCTION

The discipline "Web Technologies" refers to the compulsory educational components in the training of first bachelor's degree applicants studying under educational and professional programmes within the speciality 121 – Software Engineering. The course project is a type of independent study and quality control of student learning at certain stages of the curriculum in the speciality.

The purpose of the course project – is to systematise, consolidate and expand theoretical knowledge and develop practical skills in software development using fundamental concepts, paradigms and basic principles of software engineering tools according to the appropriate methodology.

The objectives of the course project are to increase the level of students' knowledge in the field of information technology, to help them form creative thinking, to form the basic principles of applying a systematic approach to the development of web-oriented software, as well as well-known frameworks and design templates, if necessary; to acquire skills in developing and creating appropriate supporting documentation for the created software; to equip them with universal tools of object-oriented programming.

The implementation of the course project contributes to the deepening and expansion of general and professional competencies and programme learning outcomes, in particular: the ability to apply knowledge in practical situations; the ability to comply with specifications, standards, rules and recommendations in the professional field in the implementation of life cycle processes; the ability to reasonably choose and master the tools for software development and maintenance; analyse, purposefully search and select the information necessary to solve professional problems.

The course project is defended in accordance with the course project schedule before a commission created by the head of the department and consisting of two or three teachers of the department who teach web programming-related disciplines.

The applicant, as the author of the project, is fully responsible for the decisions made in the course project, as well as the correct choice of the necessary technologies, the use of standards, etc.

General methodical advice. A course project must be prepared in accordance with university guidelines. However, as current standards are constantly being updated and improved, some of the provisions covered in the guidelines (for example,

the formatting of references) may no longer be relevant. In such cases, you should consult the journals in which the relevant changes in standards are published.

Basic requirements for the content of a course project:

– purpose;

– clarity of structure and logical presentation of material;

– depth of research and completeness of coverage of material;

– convincing arguments;

– conciseness and accuracy of expression;

– specific presentation of the results of the work, as well as evidence for the conclusions and validity of the recommendations;

– compliance of the developed project with the requirements and the terms of reference;

– clear and correct design and implementation of all project modules;

– validity of the project.

The course project is evaluated on a four-point institutional scale: "excellent", "good", "satisfactory", "unsatisfactory" and the ECTS scale (A, B, C, D, E).

A student receives an "***Excellent***" grade if he or she has completed the assignment in full, without comments from the supervisor and the examiner, in compliance with all requirements, and has demonstrated during the defence: a competent, logical presentation of the report, correct and complete answers to questions (including non-standard ones). The student has demonstrated: competent and logical presentation of the report, correct and complete answers to questions (including non-standard questions); in-depth and complete mastery of the content of the course material; ability to relate theory to practice, justify judgements, draw conclusions; possession of a variety of skills, techniques and competencies.

A grade of "***Good***" is awarded to a student who has completed the assignment in full and in accordance with the requirements and, during the defence, demonstrates a sound knowledge of the material, presents it competently and substantially, does not allow significant inaccuracies in answering questions, correctly applies theoretical provisions in solving practical problems and has the necessary skills and techniques to implement them.

The grade "***Satisfactory***" is awarded to a student who has completed the CP in accordance with the assignment, but made inaccuracies in its implementation; during the defence he/she has demonstrated knowledge of the basic educational material to the extent necessary for further professional activity; the applicant has mastered and acquired practical skills in the field, mainly copes with the implementation of practical tasks, but allows violations of the logical sequence in the presentation of the material, errors in answering questions, has difficulties in answering modified questions.

A grade of 'unsatisfactory' will be awarded if the student has completed the course project poorly and, during the defence, has demonstrably failed the course project.

1 PURPOSE AND TASK OF COURSE DESIGN

The course project is the result of assimilation of knowledge from the discipline "Web-technologies" and shows not only the students' knowledge of the subject of the course project, but also the entire software course.

The purpose of the course project – systematization, consolidation and expansion of theoretical knowledge and practical skills in software development, development of students' skills to independently and creatively highlight this knowledge when developing their own web projects, using the principles of a systematic approach to software development, as well as the ability to use them in practice. The course project, as an important form of the educational process, is designed to teach the future specialist to independently summarize and analyze information sources (monographs, textbooks, training manuals, periodical press publications, etc.), statistical and practical materials, which is later reflected in the creation of a software product.

The task of the course project is to increase the level of knowledge of students in the field of information technologies, to help them in the formation of creative thinking, to form in students the basic principles of applying a system approach to the development of web-oriented software (software), as well as well-known frameworks and design templates, if necessary; acquisition of development skills and creation of appropriate accompanying documentation for the created software; equip them with a universal tool of object-oriented programming (OOP), for example, in the Microsoft Visual Studio environment.

The performance of the work shows how deep and fundamental the knowledge acquired by the students in the process of studying the course is; characterizes the level of development of independent work skills and mastering the methods of developing completed projects when solving problems and issues that arise during course design; shows the development of the skills of analytical, graphic and literary presentation, calculation and justification of the decisions made, as well as the ability to defend them; assessment of the student's level of preparedness for independent work in modern conditions helps. The course project should prepare students for further stages of educational and practical activities. The student must learn to create high-quality software, apply – the acquired knowledge in educational and research work. The course project is completed during the semester. Students receive assignments at the beginning of the semester.

2 STAGES OF COURSE PROJECT

When writing a course work, the student must show:

– knowledge and correct understanding of laws that are formed in the field of information technologies;

– the ability to independently work with information sources, use legislative and instructional material when creating appropriate accompanying documentation;

– the ability to use the acquired theoretical and practical knowledge in the process of creating a software product, applying the modern method of a system approach to software design.

In the course project, the student must deeply and comprehensively reveal the content of the chosen topic. Special attention should be paid to the subject area.

Writing the CP in the discipline "Web technologies" is regulated by the curriculum, which is based on the educational and professional programme subject area 121 – Software Engineering and consists of the following main parts:

– selection and approval of the CP topic;

– development of a design task;

– drawing up and approving the calendar schedule of the stages of execution of the CP;

– study of the subject area in which the gram product is planned to be used;

– development of the software product structure and its software implementation;

– writing the text of the CP explanatory note;

– discussion of CP materials with the head of course design;

– final adjustment of the CP, taking into account the comments of the head of course design;

– registration of CP;

– preparation for public defense of CP;

– protection of CP.

The main stages of the implementation of the course project are indicated in Table 1.

Table 1 – Stages of course project implementation

Stage	The name of the stage
AND	Selection and approval of the topic
II	Development of the task, drawing up and approval of the calendar schedule of the stages of execution of the CP
III	Study of the subject area and development of the structure of the software product
IV	Writing and design of an explanatory note
V	Transfer of completed work to the supervisor for verification and review
VI	Preliminary evaluation and preparation for the public defence of the CP
VII	Protection

The performance schedule and topic of CP are approved at the beginning of the academic semester. The scientific supervisor and the department of software engineering as a whole control the CP's schedule of execution. A student may not be admitted to the defence in case of violation of the schedule for the execution of the CP.

The first stage is choosing a topic.

When choosing a topic, the following is taken into account:

– relevance of the research topic;

– the possibility of effective use of the developed software product;

– professional interests of the student;

– the direction of the formed scientific research work of the student.

Having chosen a topic, the student must clearly define the purpose of the course work, select appropriate scientific and methodological literature and regulatory and instructional materials.

The second stage. At this stage, the task for the course project is developed, and a calendar schedule of the stages of the course project is drawn up. The supervisor and the head of the department must sign the tasks and schedule of the course project.

The third stage. When studying the subject area, theoretical material should be worked out with the help of literary sources. The student selects literary sources independently. All types of sources, the content of which is related to the topic of the work, should be subject to review. These include materials published in various domestic and foreign publications, statistical collections, Laws and Resolutions of the Verkhovna Rada and the Cabinet of Ministers of Ukraine, and current statistical and economic data (for the last 2–3 years).

Work with literary sources should begin with compiling a complete list of textbooks, study guides, monographs, periodicals, regulatory acts and official websites. In the list of used sources attached to the term paper, it is necessary to include all the literature to which there are references and footnotes in the text, as well as those critical sources that were studied during the writing of the term paper and were reflected in the formulation of the central questions of the topic. However, there needed to be links on the job pages.

The fourth stage. A clear plan plays an important role when writing and designing an explanatory note. The plan is the basis of the work, so its preparation is one of the most essential stages. The plan should reflect the research directions of the chosen topic, the logical connection between its components, and the problem statement of individual questions. From the plan, you can see how well the student understood the chosen topic, how he understood the problem as a whole, and how he identified the essential main research directions. The correctness and completeness of the presentation of the topic, the depth of consideration of the problems, and the logic of the construction of the material depend on how well the plan is drawn up.

The optimal version of the coursework plan is at least three sections, although it can be from 3 to 5 – depending on the specifics of the chosen topic. The plan should consist of a list of central questions connected by the internal logic of the research with the topic. When drawing up a plan, the fundamental questions must be placed in such a sequence that would allow finding the most logical and acceptable scheme for presenting the material for this study. The manager must approve the plan.

After agreeing and approving the plan, the student starts writing the text of the term paper. During the writing of the paper, the plan may be refined. Clarifications are additionally agreed upon with the manager.

Fifth and sixth stages. After developing a software product and drawing up an explanatory note, the student submits the completed work for review by the supervisor. The manager checks the work and makes specific corrections if necessary. After all specified inaccuracies and errors, the student must correct the course project appropriately.

Having carried out a preliminary assessment of the course project, the supervisor allows the work to be publicly defended.

The seventh stage. The course project is defended by a committee consisting of qualified department teachers. The purpose of the public defence of the course project before the commission is to check the level of training and the ability of future specialists to work independently in the field of information technologies.

3 GUIDELINES FOR COURSE DESIGN

Course design topics should reflect the current state of development of science and technology in the field of information technologies, taking into account the prospects for their development, and should be aimed at the step-by-step creation of a software development project, including the development of UML diagrams of modules and systems under development, the development of algorithmic and software, including the development of a user-friendly interface, conducting research and analysis of results, software testing, development of documentation to support the software under development.

The main direction of the subject of coursework is formed in advance, considered, and approved at the department meeting. Appendix A provides a typical coursework topic from which the student independently chooses a specific topic for individual study. The topic is agreed upon with the supervisor of the course work.

If an enterprise, institution or organization is interested in developing a specific topic, provided it coincides with the given course. It is agreed with the supervisor that it can be proposed as a topic for the course project. In this case, a task is drawn up for the course project, which is agreed upon with the customer and approved by the coursework supervisor.

A student can propose his topic, justifying the topic's relevance and feasibility of development and drawing up a technical task, which the supervisor approves of the course work.

In general, the subject of course design is aimed at software development in the following fields:

– economic and mathematical modelling using computational methods;

– mathematical and software of computing machines and systems;
– artificial intelligence systems and tools;
– information protection systems using software;
– automation of technological processes;
– automated control systems and advanced information-technologies, etc.

Course design topics can be conditionally divided into the following areas:

– development of software elements of automated design systems;
– development of software for the automation of specific production, non-production and other spheres of social activity;
– development of software and hardware complexes for specific spheres of social activity;
– development of information systems (search, directory, expert, diagnostic, etc.);
– development of software for document management automation, record keeping, etc.;
– subsystems of automated systems and tasks of automation of information processing;
– research topics related to information technologies and their application in various spheres of social activity.

Online store selling clothes.
Online store selling shoes.
Online store selling jewellery.
Online store selling antiques
Online shop selling paintings.
Online store selling books.
Online store selling toys.
Online store selling products for pets.
Online store selling mobile phones.
Online store selling car accessories.
Online store selling household appliances.
Online store selling medicines.
Online store selling products for babies.

The specified approximate list of course work is not exclusive and can be adjusted at the student's request (with the teacher's approval).

4 STRUCTURE AND CONTENT

4.1 General requirements

The course project must be completed at a level that meets the requirements for the qualification of a third-year student using elements of synthesis analysis; if

necessary, it should include the analysis of modern technologies, methods and means of software construction, algorithmic and software development, and testing of the developed software complex, which should be accompanied by appropriate justifications, planning, optimization, and analysis. Separate parts of the work must be logically connected and aimed at achieving the development goal.

The main documents representing the CP are the explanatory note.

An explanatory note is a document in which the justification, calculation and description of the structural, functional and principled decisions made in the KP are provided. The text of the explanatory note to the course project should be presented concisely and in a reasonable style.

Copying of literary resources and using Internet reviews not processed by the student are not allowed.

Copying of literary resources and use of Internet reviews not processed by the student are not allowed.

Verbatim copying of other authors' materials on this topic is also not allowed. In this case, citing specific literary or Internet sources with a mandatory link is only possible. If plagiarism is found, this work is returned to the student without the possibility of defending it. Course enrollment design results are possible only in the case of complete independent writing of this type of work.

The course project generally includes an explanatory note (EN) and a graphic part. The explanatory note is made on sheets of A4 format according.

The graphic part is drawn up on A2 sheets (there must be at least two drawings): UML diagrams, block diagrams, screens, tables of user functions, etc.

In the graphic part, it is recommended to write developer codes indicating the type of work or project and the designation of the direction of preparation. The characteristic code for students is the number of the credit book. If the passbook number consists of only five digits, zero is the first digit in the characteristic code. In addition, the code of the explanatory note – EN is written at the end of the designation. Example of CPSE – course project of a student majoring in "Software Engineering"; full designation: CPSE. 140201.14.12.E8.

Here, the first 5 digits are the score book number, the next 2 are the group number, the last are the numbers on the list, and E8 is the designation for graphic material.

Example

CPSE – course project of a student of the "Software Engineering" training course with credit number 140201 of group 14–16, according to list 12; full designation: CPSE. 140201.14.12. E8.

An example of the framework can be found in Appendix B.

An explanatory note to a course project should have a clear and logical structure: an introduction, the central part, a conclusion, a list of used sources and appendices.

The approximate structure of the explanatory note is given in Table 2.

Table 2 – Structure and scope of the explanatory note to the CP

Basic elements	Recommended volume (p.)	Notes
Title page	1	Appendix C
Design tasks	1–2	Appendix A
Content	1	Appendix E
Introduction	1–2	
Main part:		
Chapter 1	8–12	
Section 2	8–12	
Section 3	8–12	
Conclusion	1–2	
references	2–3	At least 25–30 resources
Appendices		As necessary

The graphic part of CP includes drawings, schemes, algorithms, models, programs, schemes for organizing databases and knowledge, network structures, etc. In each specific case, the composition of the graphic material and its volume are determined by the head of the CP and the head of the department of software engineering for drawing up and approving design tasks.

The content of the KP depends on the topic and nature of the project.

The volume of the coursework is ***40 pages*** of computer text, considering schemes, tables, graphs, and diagrams.

The title page is the first page of the explanatory note and is filled out according to the established form, which is presented in Appendix B. The title page is considered the first page and is not numbered as a section, included in the table of contents, or numbered.

It indicates the name of the ministry, university, institute, faculty, department and the topic of the course project (in exact accordance with the individual or technical task).

The student himself signs the cover letter, as the head of the course project and is a member of the defence commission. The names of persons from the list of academic degrees and titles are indicated along with the signatures.

The task for course design is the second page, which has a prescribed form (Appendix A), is attached when submitting the work and is not included in the general list of pages.

The design task is the source document for the execution of the CP. The head of the CP compiles the task by the chosen topic, approved by the head of the department and issued to the student. The task specifies:

– the name of the higher educational institution, institute, faculty, or department;

– code and name of the direction of training (specialty);
– topic of CP;
– date of approval of the topic,
– the deadline for the student to submit the completed work to the department;
– output data to CP;
– the content of the explanatory note (list of issues being developed);
– a list of graphic materials (if the graphic part is planned);
– calendar plan.

The head of the CP and the student sign the assignment. The head of the department approves the task. The assignment can be printed on both sides of the A4 sheet. A design assignment template is provided in Appendix A.

In ***the content*** of the work, the names of the issues of the approved plan are sequentially recorded (with possible adjustments and clarifications), and the page number from which the sections and subsections begin is determined (Appendix E).

The following requirements apply to the content and central part of the work:
– systematicity, consistency and specificity of presentation of the material;
– logic and scientific style of the presented material;
– completeness of presentation of each thought.

The materials of the course project must be presented following the content, concisely and succinctly, without allowing repetitions and unnecessary deviations from the topic – inadmissible mechanical write-off. The work must be purely creative.

In the introduction (1–2 pages), it is necessary to substantiate *the chosen topic's relevance,* scientific significance and the extent of its research. It is necessary to determine *the purpose* and *tasks* of the course project, indicate the research methods used during the writing of the paper, determine *the object* and *subject* of the research, give a brief description of the structure of the work, and indicate the information base.

The relevance of the research topic – through critical analysis and comparison with known solutions to the problem (scientific problem), the relevance and expediency of the work for the development of the relevant branch of science or production, especially for the benefit of Ukraine, are substantiated.

Coverage of relevance should not be wordy. It is enough to express the main thing – the essence of the problem or scientific task – in a few sentences.

The aim of the study is associated with the object and subject of research, as well as with its final result and the way to achieve it. The final result of the study involves students solving a problem that reflects the contradiction between the typical state of the research object in actual practice and the demands of society for its more effective functioning. The final result reflects the positive effect expected from the implementation, which is formulated in two stages: the first part – in the form of social utility, and the second – in the form of a specific benefit attributed to the main subject of the study.

The presence of the set goal of the research allows you to determine ***the tasks of the research***, which may include the following components:

– solving specific theoretical and practical issues that are part of the general research problem (for example, identifying the essence of concepts, phenomena, and processes, further improving their study, developing features, levels of functioning, performance criteria, principles and conditions of application, etc.);

– a comprehensive, based on factual material study of the practice of solving this problem, identifying its typical state, shortcomings and difficulties, their causes, and typical features of best practice; such a study makes it possible to clarify verify the data published in special non-periodical and periodical publications, raise them to the level scientific facts substantiated in the process of unique research;

– justification of the necessary system of measures to solve this problem;

– substantiation of the feasibility of the proposed system of measures in terms of compliance with its efficiency criteria, i.e. achieving the most important results of solving this problem in the relevant conditions with a certain expenditure of time and effort.

The object of research is a process or phenomenon that creates a problem situation and is chosen for research.

The subject of study – these are only those essential connections and relationships subject to direct study in this work, which are the main ones determining a specific study. Thus, the subject of research is narrower than the object.

When defining an object, one must find an answer to the question: ***What is considered*?** At the same time, the subject determines the point of view of consideration, gives an idea of the content of consideration of the object of research, and describes what new relations, properties, and functions of the object are revealed. In other words, the object is what is being investigated. Moreover, the subject is that which has a scientific explanation in this object.

4.2 Approximate structure of sections of the main text

It is recommended to adhere to the following structure of sections of the main text when writing a course project in the discipline "Web technologies".

Introduction

(There must be purpose and relevance of the work, topic, goal, subject, and research object.)

1 Study of the subject area.

(In this section, a description of the subject area (designation of the site, roles and possible operations), analysis of existing similar developments, drawing up a technical task, describes the features and limitations of the site.)

2 Designing the structure and components of the project.

2.1 Site design. (Description, schematic layouts (or .psd layouts) of the site pages. Description of the navigation system. Development of the logical and physical structure of the site).

2.2 Database design and implementation. (Description of information structuring logic, database ER diagram).

3 Implementation of the project.

3.1 Selection and description of software for the implementation of the task.

3.2 Implementation of the database.

3.3 Implementation of the site (the site's development process and its components are consistently described and demonstrated with screenshots and code fragments).

3.4 Administrator and user instructions.

4 Project testing: All project capabilities are demonstrated. At the same time, correct operation and erroneous situations are shown with the help of screenshots with corresponding descriptions. The project validation result is displayed.

List of literature

Appendices

It can enter and change other sections in agreement with the manager.

The central part of the explanatory note consists of sections that reveal the content of the course design according to the chosen topic and set tasks.

In the central part of the work, the student must outline the central theoretical positions of the work, supplement them with modern concrete material, consider specific points of view regarding the chosen problem, justify his views, answer the questions posed in the introduction, achieve the goal of the research, outline its geographical, chronological and other frameworks.

When presenting the material, it is necessary to be guided by generally accepted terminology and not to use abbreviations of words other than generally accepted ones.

4.3 Design tasks

The design task is the starting document for course design. The task is compiled by the head of the CP and the student by the chosen topic, approved by the head of the department and issued to the student.

The task specifies:

– name of higher educational institution, faculty, department;

– code and name of training (programme subject area);

– topic of CP;

– date of approval of the topic;

– the deadline for the student to submit the completed work to the department;

– output data to CP;

– the content of the explanatory note (list of issues being developed);

– a list of graphic materials (if the graphic part is planned);

– calendar plan.

The task is signed by the head of the CP and the student, and the head of the department approves the task.

A design assignment template is provided in Appendix A.

4.4 Sections of the main text

4.4.1 Section "1 Study of the subject area"

The first section is the theoretical part of the work. The section reviews the state of solving the problem, considering the latest achievements of science and technology. The depth of the review in geographical and temporal aspects characterizes its completeness. An analysis of scientific and technical domestic and foreign literature over the past few years is sufficient.

Based on the analysis, the main ways of solving the problem are determined, their analysis is carried out from the engineering and scientific points of view, and the optimal one is selected. At the same time, the research purpose is formulated, and the results to be obtained are specified.

This time serves as a theoretical basis and a prerequisite for applied aspects of the topic, so the issues considered in the work's theoretical section should become a basis for applied development, which will be carried out in the second section. Completing this work will allow the student to receive a complete scientific work. When studying the theoretical foundations of certain problems, the student should review the technical literature in this subject area. Such material in the work should show the student's thorough familiarity with special literature and ability to systematize sources, critically examine them, analyze various approaches in scientific thought, highlight the essentials, and draw reasoned conclusions.

Also, this section provides an analysis of existing solutions, in particular, the use of certain frameworks in the development of the site, software analogues, etc., which fully or partially solve the task. It is also worth indicating the advantages and disadvantages, strengths and weaknesses, of the existing projects.

Based on the analysis of the subject area and the compiled list obtained during the requirements analysis, based on the advantages and disadvantages of existing analogues and functionality, a concise, well-founded description of the developed software product is given, indicating its main functions and capabilities.

4.4.2 Chapter 2 "Designing the structure and components of the project"

Chapter 2 contains the rationale and development of the algorithm and software.

The composition of this section is determined by the topic and task for the coursework.

A prerequisite for writing style is reasonableness and variability. When considering any issue, it is necessary to consider possible solutions, analyze them and choose the optimal one. The development of software accompanies this part of the CW with a justified choice:

– instrumental means;
– memory usage options;
– object, procedural or non-structural approach;
– operating environment;

– the best algorithm of the program or some subprograms or modules;
– an optimal structure of the software being developed.
This section may contain:
– analysis of the functions of the software being developed;
– development of a structural model of the software;
– development of UML usage diagram;
– development of UML behaviour diagrams of the software being developed;
– graphic interface development;
– UML interaction diagram;
– development of the structure of the database files (if the goal of the CW is the development of the database and its processing programs).

4.4.3 Chapter 3 "Implementation of the project"

This section deals with issues directly related to technical activities, the main purpose of which is to prepare the project for implementation.

There, the selection and description of the software for the implementation of the task and the implementation of the database are carried out.

When describing the implementation of the site, it is necessary to carry out a consistent demonstration with screenshots and code fragments, as well as the development process of the site itself and its components.

One of the sub-items can be the instruction of the administrator and the user.

4.4.4 Chapter 4 "Project Testing"

This section should contain recommendations or proposals for improving the problematic aspects of the research subject identified in the second question. In this section, the development of software modules, testing, integration, verification and validation of the software system is carried out. This section may contain:
– development of tests to verify the correctness of the software project;
– user manual.

Each question should end with a summary of conclusions that express the author's opinion.

Coverage of the main part of the work may include digital data that can be presented in the form of tables and figures (diagrams, diagrams, graphs).

4.5 Conclusions

The conclusion of the course project should follow from the conducted research and be related to its results. The conclusions sum up all the highlighted issues and determine the ways and directions of solving problematic aspects of the topic.

Recommendations should be developed by the student independently based on practical experience. Conclusions on CW should describe in an abstract form the results obtained by the student at each of the stages of work performance (analytical, system software design stage, experimental research, analysis of the obtained

results), as well as conclusions regarding the achievement of the goal of the course design, prospects for the development of this field etc.

It considers the following issues:

– the purpose and task to which the CP is dedicated to solving is indicated;

– a description of the methods and means of information technologies used to realize the set goal is provided;

– a description of the works that were performed to solve the specified task is provided (the works are considered in their relationship, with observance of the sequence of their execution and determination of the results obtained at each stage of the design);

– a general conclusion is made based on the design results.

All materials should be presented briefly as a summary of the completed work. In the conclusions, it is desirable to use a multi-stage description of the performed works (for example, In the section... performed..., As a result, it was determined that..., The developed software product allows..., The developed software product can have the following areas of application..., In the future, the software product can be improved due to...).

Conclusions are written on 1–2 pages, not numbered as a section.

4.6 List of reference sources

At the end of the work, a list of used sources is attached, compiled under the rules of bibliographic design of scientific works intended for publication (Appendix D). The list should be formed in the order of references by text and contain bibliographic information of officially published books, articles, patents, deposited manuscripts, etc. As a section, the bibliography needs to be numbered.

4.7 Attachments

Appendices contain material that complements or illustrates the main text of the document. For example, you can place drawings, large-format tables, calculations, descriptions of algorithms and programs, logic diagrams of programs and their listings, test methods and protocols, acts of introduction into production, copies of patents received by the student, and other materials that help to reveal more fully and in detail the plan and ways of implementing the CP. In addition, the appendices include tables, graphs, and methods, which, for some reason, were not included in the explanatory note but are needed for explanations.

Attachments can have mandatory or reference status. In the reference – appendix, reference information is provided. In the mandatory appendix, a detailed description of the document's individual provisions is provided to avoid overloading the main text. When performing CP, it is recommended to include block diagrams of algorithms and the complete code of the software product in the mandatory appendices.

The terms of reference (Appendix K) should be the first appendices. It states:
– name and field of application of the object of development;
– the basis for carrying out projects;
– project start date – dd.mm.yy;
– project completion date – dd.mm.yy;
– the purpose of design;
– destination indicators;
– reliability requirements;
– development stages and stages;
– safety requirements.

The technical task is formulated in an abbreviated form, and the developer determines the list of necessary items.

As a section, the appendices are not numbered. However, each of the appendices is numbered with uppercase letters of the alphabet because to the appendices, if documents with independent page numbering are mixed, the different numbering (common to the entire explanatory note) is preserved.

The manager determines the deadline for submission of work for verification and review according to the schedule of the educational process.

5 REQUIREMENTS FOR FORMING THE DOCUMENT

5.1 General provisions

The structure and content of the CP should be brought into line with the topic of the CP. One of the important criteria for the correspondence of the content of the CP to its topic and structure is the structure of the work, from which you can get an idea of the completeness and quality of the material presented in the work and the level of disclosure of the topic, the presence of conclusions, recommendations, etc.

CP includes an explanatory note, appendices and graphic parts.

An explanatory note is a document formed from a text that describes and substantiates the decisions made by the CP. The explanatory note discloses the work plan, includes research models and methods, used technologies and algorithms to solve the problem, calculations, their analysis and conclusions, a description of the program implementation and, if necessary, is accompanied by drawings, diagrams, graphs, charts, etc. The text of the paper is created on a computer using text editors (Microsoft Word, Open Office.org Writer, etc.).

The distance from the frame of the form to the text's borders at the lines' beginning and end is set at the size of 5 мм. The distance from the upper (lower) text line to the upper (lower) frame is 10 мм. When setting the dimensions of the page borders, it should be borne in mind that the distance of the frame to the edges of the sheet should be as follows: from the left edge – 20 мм, from the right, top

and bottom – 5 mm. The following requirements must be observed for the text: font – Times New Roman; set height – 14 pt; line spacing – 1.5 (one and a half); alignment of the main text – by width; font colour – auto (black). Suppose there are fragments of program codes in the text of the explanatory note. In that case, they should be highlighted in a different font and font size (but not less than 10 pt) for a better perception of the content of the explanatory note material.

Paragraphs in the text must begin with an indent equal to 15 мм, and it must be the same throughout the text. It is not allowed to place only one word (or part of it) in the last line of a paragraph. If such a case exists, then to avoid it, the text of the paragraph should be reformulated accordingly. It is also possible to use compressed spacing between characters within a paragraph (or its lines), but no more than 0,04 pt.

The document should be free of damaged sheets, errors, remnants of destroyed text, etc. Errors and graphic inaccuracies can be corrected by erasing or colouring with a corrector and applying the corrected text (drawing) in the same place by hand or printing.

The names of institutions, organizations, enterprises, surnames, and other proper names in the text are given in the original language. It is allowed to transliterate proper names and indicate the names of organizations in the translation into the document's language, giving the original name (at the first mention). The CP explanatory note (excluding appendices) should be 30 to 55 pages long.

5.2 Layout of the title page

The first page of a text document is the title page, which is the main source of bibliographic information necessary for processing and searching the document. The title page contains data submitted in the following sequence:

– name of educational institution and department;
– title of work (in capital letters);
– purpose of work (in capital letters);
– signatures of the work developer and responsible persons;
– the year of creation.

According to [7], each project is given a conditional designation. The designation was introduced for electronic accounting in educational institutions. Notation for course projects has the following general form:

XXXX. XXXXXX.XX.XX.XX

In this notation, the first group of symbols (up to the first dot) is the document code, which consists of the type of document (course project (CP) and the code of the specialty (PE, SE, etc.). The second group of symbols (placed between the first and second dots) defines the code of the student's individual plan, The third group of symbols is the group number. The fourth group is the number of the individual task (usually according to the student's serial number in the group). The last two digits are the purpose of the document (EN – explanatory note).

Examples

CPSE – course project of a student in the "Software Engineering" field of training; full designation: CPSE.140206.14.11.EN

The title page is made on an A4 sheet.

An example of the design for the title page of the CP is given in Appendix G.

5.3 Basic requirements for the presentation of text documents

5.3.1 Text division

Considering that the explanatory note is a document, it consists of text. The structure of the explanatory note is as follows: introduction; main part; applications. The main part can be divided into sections, starting on a new page. In turn, sections can be divided into subsections and clauses and clauses into subsections. A mandatory condition for dividing this text into points and subsections is the completeness of information in each section or point. The numbering of sections, subsections, clauses and sub-clauses is carried out with Arabic numerals from the paragraph indentation. Each section is numbered within the document and indicated by Arabic numerals without a period.

Subsections are sequentially numbered within each section. The number of the subdivision is formed from the number of the section and the serial number of the subdivision, separated by a dot. There is no need to put a period after the unit number. Sections and subsections may consist of one or more clauses.

Paragraphs should be sequentially numbered within each section or subsection. The item number consists of the section number and the item serial number or the section number, subdivision serial number and item serial number separated by a period. There is no need to put a period after the item number.

Example

INTRODUCTION
1 TITLE OF SECTION 1
1.1
1.2
} Нумерація пунктів першого розділу
2 TITLE OF SECTION 2
2.1
2.2
} Нумерація пунктів другого розділу
3 TITLE OF SECTION 3
3.1 Name of the first subdivision of the third section
3.1.1
3.1.2
3.1.3
} Нумерація пунктів першого підрозділу третього розділу
3.2 Name of the second subdivision of the third section
3.2.1
3.2.2
} Нумерація пунктів другого підрозділу третього розділу
CONCLUSIONS

If the document is divided only into points, they are numbered with sequential numbers within the limits of this document.

Items can be divided into sub-items with sequential numbering within each item.

Such structural elements as "Contents", "Introduction", "Conclusions", and "List of references" do not need to be numbered, and their names are headings of structural elements; they are written in the middle of the page with a capital letter. Capital letters are allowed.

5.3.2 Headings

Sections and subsections must have headings, and clauses and subsections may have headings. Headings should clearly and concisely reflect the content of the structural element.

Headings begin with an indented paragraph and a capital letter (it is allowed that all letters in the heading are written in capital letters) without a period in the end but without underscores. Moving words in headings is not allowed. If the title consists of two sentences, separate them with a period.

Two free lines should exist between the title (section, clause, subsection) and the previous and subsequent text. Leave one free line between the section headings and subsection (item). By analogy, there should be one free line between the subsection headings and the clause.

Example

1 Study of the subject area
1.1 Characteristics of the functional structure of the subject area
free line
free line
Further text...
…
...previous text
free line
free line
1.2 Analysis of recent publications, research and existing solutions
free line
1.2.1 Review of publications
free line
free line
Further text...

It is not necessary to place the title of the section, subdivision, as well as item and sub-item at the bottom of the page, provided that there are less than two lines of text after the title. In this order, it is permissible to change the line spacing within one page, but not more than by 0.04 (use the value of the multiplier from 1.46 to 1.54).

5.3.3 Presentation of the text

It is important to pay attention to the fact that the full name of the document on the title page, in the main inscription and at the first mention in the document's text must match.

The text of the document itself must be concise, accurate, logical, and consistent and must correspond to the main points of the course project of the discipline. The text is written without errors, using the business speech style used for official documents. It is necessary to use established vocabulary, which is inherent in academic dictionaries. It is necessary to avoid dialectics, fiction style, the latest foreign language borrowings, etc.

When submitting mandatory requirements, you must use the words "can't", "necessary", "must", "must", "must", "only allowed", "can". When setting out other provisions, it is advisable to use the words "maybe ", "as a rule", etc. It is allowed to use an arbitrary form for teaching the text, for example, "apply", "mark", "produce", "execute", etc.

The text should use scientific and technical terms, designations and definitions established by relevant standards and, in their absence – generally accepted in scientific and scientific-technical literature.

In the text, it is not necessary to use:

– colloquial turns;

– technicalities and professionalisms;

– different scientific and scientific-technical terms for the same concept, close in content, as well as foreign words and terms if there are similar words in the Ukrainian language;

– arbitrary phrases;

– abbreviations of words other than those established by the rules of Ukrainian spelling and current standards;

In the text of the document, in addition to formulas, tables and figures, it is not necessary to use:

– the mathematical sign minus (–) before the negative value of the quantity (the word "minus" must be written);

– the symbol " ∅" to indicate the diameter (the word "diameter" must be written); but when indicating the size or the limit deviations of the diameter in the drawings, the sign " " must be placed before its numerical value ∅;

– mathematical symbols without numerical values, for example: >(greater than), <(less than), =(equal to), ≥(greater than or equal to), ≤(less than or equal to), ≠(not equal to), as well as № (number), % (percentage), and °C (degrees Celsius).

When specifying the largest or smallest value of a quantity, the phrase "must be no more (-th, -a) than (from, for)", "no less (-th, -a) than (from, for)", "not should (-en, -a) exceed".

If the permissible values of deviations from the specified norms and requirements are specified, it is necessary to use the phrase "must not be greater than (from, for)", "less than (from, for)", "must not exceed".

In the text itself, it is necessary to use the terms, definitions, conventional designations, images and signs established in the current standards. Before marking each parameter, it is necessary to give its explanation.

5.3.4 Formulas and equations

To write mathematical formulas and equations, you should use the formula editor built into the word processor (for example, Microsoft Equation 3.0). The style of the formula should be mathematical; the size of the elements of the formula should be commensurate with the font size of the main text. Using typewritten and handwritten symbols in the same formula is impossible.

Formulas are placed directly after the text where they are mentioned, in the middle of the page. One free line must be left between the text and each formula.

Formulas (except formulas in the appendices) must be numbered sequentially within the section with Arabic numerals and written at the level of the formula in round brackets in the extreme right position on the line. The formula number includes the number of the section and the serial number of the formula in that section and is separated by a period, for example, (3.1). You can also apply end-to-end formula numbering (except for appendices). If there is only one formula in the document, it is marked with (1).

It is necessary to explain each notation contained in the formula. Explanations are given on a new line in the order in which they appear in the formula. The first line of the explanation must begin with the paragraph with the word "where" without a colon. After explaining the notation, the unit of the corresponding physical quantity is written with a comma.

Example

The density of each element ρ in kilograms per cubic meter is calculated using the formula

$$\rho = \frac{m}{V}, \qquad (1)$$

where m *is* the mass of the element, kg;

V – element volume, m^3.

Formulas that follow one another and are not separated by text are separated by a comma and written in a column.

Example

$$A = \sqrt[3]{\frac{a}{b}}, \qquad (3.1)$$

$$F = mc^2. \qquad (3.2)$$

It is possible to transfer the formula to the next line (if it does not fit in one line). Transferring the formula to the next line is possible only for sign operations, while the sign at the beginning of the next line is repeated. If the formula is transferred to sign multiplication, use the sign “×”.

The order of presentation of mathematical equations in the text is the same as that of formulas.

5.3.5 Tables

In general, tables are used for better presentation, visualization and ease of comparison of various indicators.

Tables (except tables in the appendices) are numbered within the section with Arabic numerals. The table number includes the section number and the serial number of the table in that section, separated by a dot:

Table _____ – _____
Number Name of the table

The name of the table should reflect the content of the table, be specific and concise. The name of the table is written with a capital letter and is located above the table (beginning above the upper left corner). A dot is not required at the end of the table name

End-to-end numbering of tables in the document is possible (except for appendices). If there is one table in the document, then it is marked “Table 1”.

Example

Table 3.2 – Name of the table

Costs V $_{in}$	*A*	*B*	H_1	H_2	Total
10	2	3	4	5	16
60	160	190	525	600	170
200	195	210			270
600	330	400			700

Headings of columns and rows of the table should be written with a capital letter, and sub-headings of columns should be written with a small letter if they form one sentence with the column heading, or with a capital letter if they have the same constant value. A full stop is not required at the end of a heading or subheading. The form of nouns in headings should preferably be singular. The column headings and the text of the table rows are placed on the left at the zero position, depending on the specifics of the table.

Lines frame the left, right, top and bottom tables. The horizontal and vertical lines that delimit the rows and columns of the table can be included if this makes the table easier to use. It is not necessary to separate headings and subheadings with diagonal lines.

If a part of the table is transferred to another or the same page, then the name is placed only above the first part of the table; above its other parts, only the number of the table is placed with the following inscription (above the upper left corner, from the first capital letter): "**Continuation of table ___**" or " **End table ___**". At the same time, the transferred parts are marked with column numbers in the table's header, provided that these numbers are displayed in the first part of the table. The lower limiting horizontal line is indicated only in the final part of the table.

Example

Table 1.1 – Name of the table

In centimeters

Length *h*	Width *s*	The border			
		Internal		External	
		a	*B*	*a*	*b*
1	*2*	*3*	*4*	*5*	*6*
2.0	2.1	0.5	0.8	0.5	0.5
3.0	3.1	0.8	1.0	0.8	0.8

Continuation of table 1.1

In centimeters

1	2	3	4	5	6
3.5	3.5	1.0	1,2	0.9	1.0

End of table 1.1

In centimeters

1	2	3	4	5	6
4.5	4	1.6	1.3	1.8	2

Each table requires a reference in the text; when referring, write the word "table" and indicate its number. According to its size, the table itself is placed after the text in which it is indicated or as close as possible to the first mention. It is possible to arrange the table on the album orientation sheet.

Tables with a small number of columns can be divided into parts and placed one part next to another on the same page, repeating the table header.

Example

Table 1.1

Apples, kg	Tomatoes, kg
2.1	0.5

Pears, kg	Tomatoes, kg
12.0	2.6

5.3.6 Drawings

The drawings must comply with the requirements of the USCD and UPSD standards. Drawings are suggested to be made with the help of graphic editors or special software tools for constructing schemes, processes, drawings, etc., with their subsequent insertion into the document. Graphic tools built into the text editor are allowed.

When making drawings, it is suggested to set the thickness of the lines from 0,75 pt to 1,25 pt; the colour should be black; the font of the inscriptions should be Times New Roman, and the font size should be 12 to 14 pt.

All figures in the test must have the same caption, "Figure".

Pictures are placed in the document right after the text, where they are mentioned for the first time (or on the next page), symmetrically to the text, setting the picture's position – "in the text". All figures must be referenced in the text.

Figures are numbered with Arabic numerals with sequential numbering within the section (except for appendices). The drawing number consists of the section and the serial number of the drawing in this section, separated by a dot (the dot is not placed at the end of the number).

Example

Figure 1.2

If the document contains only one figure, it is marked "Figure 1".

End-to-end numbering of drawings is allowed (except for appendices).

Drawings are signed so that the title reflects its content and is specific and concise. The name is written with a capital letter and is symmetrically located below the picture. A dot is not needed at the end of the figure name.

Example

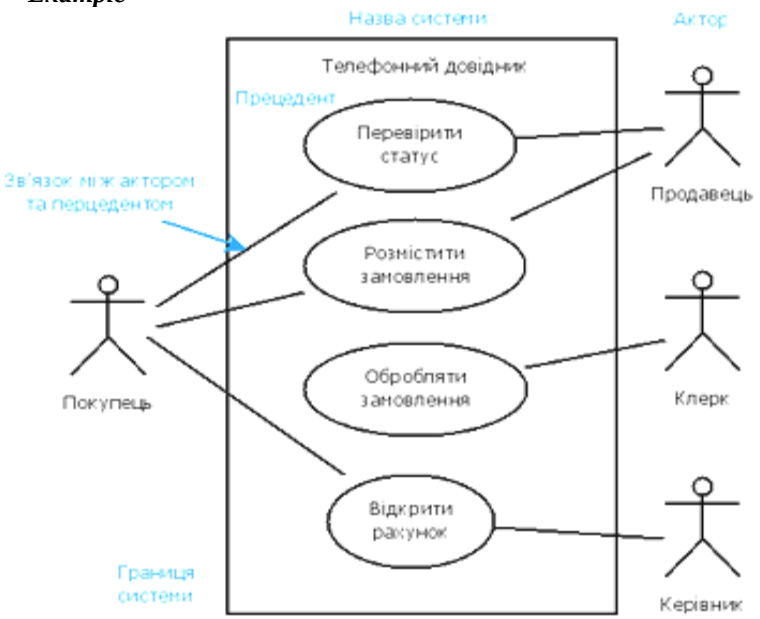
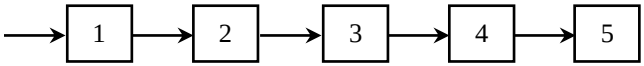


Figure 2.1 – Use case diagram

If necessary, the explanation of the figure is given directly after it and before the figure's name. To record explanatory data, use a font size smaller than the main text's (but not less than 12 pt).

Example



1 – ATM; 2 – servers of the 1st level;
3 – central server; 4 – servers of the 1st level; 5 – ATM

Figure 2.3 – Transaction sequence of the banking system

The drawing is done on one page. Provided that if it does not fit on one page, then it can be transferred to other pages, while the name of the figure is given on the first page, explanatory data (if necessary) on each page, and the figures indicate:

Figure _____, sheet _____
Number Number

The names of figures in the text, when referring to them, must match the caption of the figure.

5.3.7 Examples

Examples are given in those cases when they explain parts of the text in the document or contribute to its concise presentation.

The word "Example" ("Examples") is allowed to be written from a paragraph with a capital letter without any sign at the end. The text of the example(s) is placed on a new line after the word "Example(s)" from a double paragraph. If there are several examples, they should be placed one under the other. Examples can be numbered with Arabic numerals.

5.3.8 Abbreviations and conventions

The following abbreviations can be used in the text of the document:

– common abbreviations: see – look; nominee – nominal; grain. Departure – limit deviation; min. – minimal; max. – maximum and other abbreviations established by the rules of Ukrainian orthography and DSTU [4];

– abbreviation: abs. – absolute; relative – relative; with. – page; r. – year; hryvnia – hryvnia; k. – a penny; c. – price, million – million; billion – billion and other abbreviations used with numerical values.

Suppose the explanatory note contains its own system of abbreviations of words and names. In that case, the list of accepted abbreviations is provided at the end of the document in the special section "Abbreviations and conditional marks".

5.3.9 Notes

Notes are created if there is a need for comments on the content of the text, tables or figures. Notes are placed directly after the text, fragment of the

figure or at the end of the table to which they relate. If one note is submitted, it is preceded by the word "Note", written from a paragraph and with a capital letter, followed by a period. Next, the note's text is written in the same line with a capital letter across the space.

Example

Note. The sizes in parentheses are not recommended.

If there are two or more notes in a structural element, they are given after the text to which they relate and are numbered with Arabic numerals.

Example

Note 1. Text of the note.
Note 2. Text of the note.

Notes to the tables are placed at the end of the table above the line that marks the end of the table and are separated from its main part.

5.3.10 Links

References in the text to sources should be marked with a serial number in the list of references, separated by two square brackets.

Examples

"...in work [8]...";
"...in works [1–5]...";
"...the method is used ... [5]."

When referring to sections, subsections, points, figures, tables, formulas, equations, appendices, their numbers are indicated. When referring, it is necessary to write: "...in the section 4", "...see 2.1", "...in accordance with 2.3.4", "...in the figure 1.3 ", "(figure 5)", "...in figures 1.3–1.5", "...in the table 3.2", "...in accordance with formula (3.1)", "...in equations (1.2) – (1.5)", "...in appendix B", etc.

5.4 Content design requirements

The content of the CP is placed on the title page (main form) and, if necessary, on the following sheets (simple forms).

The word "Content" is placed as a title in the middle of the page with a capital letter (it is allowed to be written in capital letters). The names of all structural elements included in the content are written with the first capital letter. The content is added to the total number of pages of the document.

5.5 Requirements for registration of reference sources

This section lists the sources used in the explanatory note. Literary sources can be books, multivolume publications, periodicals (newspapers, magazines), special

types of regulatory and technical documents (standards, patents, catalogues), electronic resources, etc. The names of the literary sources of reference are given in the language they are written.

Bibliographic descriptions of references in the list are provided following DSTU 8302:2015.

A bibliographic record of any source is included in the list of references only once. Each source has its serial number, and the entire list has a single end-to-end numbering.

Sources should be cited in appropriate places in the text.

Examples of bibliographic design are given in Appendix G**.**

5.6 Requirements for applications

Annexes are drawn up as a continuation of the document, numbering the pages of the appendices and continuing the numbering of the pages of the explanatory note.

Appendices are marked sequentially with capital letters of the Ukrainian alphabet, starting with A, for example, "APPENDIX D". It is allowed to mark applications with letters of the Latin alphabet. If there is only one appendix in the document, it is marked as "APPENDIX A".

Each application must be started on a new page with the word "APPENDIX" and its designation at the top in the middle. The next line should contain the application's name, written symmetrically concerning the text with a capital letter. The text of each appendix can be divided into sections, subsections, paragraphs, and subsections numbered within each appendix. Numbers are preceded by the letters of this appendix (A.1, B.3.2).

If there are figures, tables or formulas in the appendices, they are also numbered within each appendix (figure A.1, table B.3, formula (C.1)). If there is one figure, one table, one formula in the appendix, they are numbered, for example, figure A.1, table D.1, formula (B.1).

End-to-end numbering of figures, tables, and formulas (unlike the main text) in the appendices is not allowed.

Texts of program codes in applications may be highlighted in a different font type and/or font size (but not less than 10 pt) from the main text. It is also allowed to reduce the line spacing to 1.

If a document of independent importance (for example, patent studies, technical conditions, technological regulation, certified research methodology, article, etc.) is included in the appendix and is designed in accordance with the requirements for this document, then a copy of it is placed in the appendix without any changes. The pages of the copy of the document are numbered, continuing through the numbering of the explanatory note, despite the numbering of the pages of the copy of the document.

5.7 Numbering of pages

The CP pages are numbered with Arabic numerals (do not put a period at the end). At the same time, the end-to-end numbering is observed throughout the document, including the appendices (except for the " Design Task" sheet, which is not included in the general page numbering and is not numbered).

The title page is included in the overall page numbering (numbered 1), but the page number is not on the title page.

Figures and tables placed on separate pages are included in the overall numbering of the document's pages.

The page number of the main text is inserted in the corresponding column of the form in the lower right corner (field page).

The page numbers of the applications are placed in the upper right field.

6 PROTECTION OF PROJECTS

6.1 Preparation for defence

Preparation of documentation. In order to conduct the defence, the student must submit to the supervisor a fully prepared project containing:

– stapled document with signatures of responsible persons and dates on the title page, the design assignment and within the corner frames (corrections are not allowed); the document sheets are stitched in the same sequence as specified in clause 4.1.

– drawings and posters with signatures of responsible persons and dates within the corner frames (if the work contains a graphic part, corrections are not allowed);

– additional materials characterizing the scientific and practical value of the work: printed articles, theses of reports, documents on the practical application of the work, etc.;

– an extract from the protocol of preliminary protection (if such is carried out);

– certificate of anti-plagiarism check.

Suppose the research object of the course project was an organization (enterprise, institution). In that case, the student adds a review of the head of this organization, certified by a seal. This feedback should testify to the reliability of the information given in the work and the truthfulness of the factual data. It should confirm the topic's relevance for the enterprise, the author's independence of the research, practical significance and the possibilities and prospects of implementing the proposed solutions.

If the course project does not meet the specified requirements, the student may not be admitted to the defence.

6.2 Checking for plagiarism and its elimination

Khmelnytskyi National University is governed by the "Regulations on Observance of Academic Integrity at Khmelnytskyi National University", according to which an anti-plagiarism check is carried out.

According to Regulation [12], course projects are checked for signs of academic plagiarism following the decisions of academic councils of faculties and/or relevant departments using the Anti-Plagiarism software and technical tools. Threshold indicators of percentages, which determine the uniqueness of the text of educational works, are established for each speciality (educational program) by the department's decision but must not be less than the values established in clause 7.1.6 of this Regulation. Checking the level of borrowings in the course project is carried out five days before the defence of the project. A responsible person at the department carries it out in accordance with the orders of the head of the department.

The functions of the responsible person are:

− uploading the explanatory note of the course project to the Anti-Plagiarism system and carrying out its computer check for plagiarism;

− issuing a certificate based on the results of the inspection.

If, according to the results of the appropriate analysis of the report of the examination of academic work for the presence of signs of academic plagiarism, the correctness of references to the primary source for textual and/or illustrative borrowings is established, then the work (depending on its type) is allowed to be defended, reviewed or considered, it is recommended for publication, is considered to have passed internal review [12].

If, as a result of the examination of the academic work, the presence of minor technical errors found in the review part of the work, which does not describe the author's direct research, textual, illustrative borrowings and paraphrases without proper reference to the original source, such work is returned to the author for revision with the possibility of revision and submission for re-checking [12].

If, as a result of the examination of the educational work, the Responsible (if necessary, with the involvement of an expert) established the fact of the presence of intentional textual and illustrative distortions, attempts to hide borrowings, the presence in the works of ideas and scientific results obtained by other authors, or other manifestations of academic plagiarism, then the work (depending on the type of work) is not allowed for protection, it is considered that it has not passed internal review [12].

A maximum overlap with one work of no more than 40 % is allowed for a course project. The presence of errors in the project should be at most 20 %, and in the case of using specific terms (which may not be in dictionaries) – 30 %. Also, the work should have at least 60,000 characters (300 tokens).

In case of detection of plagiarism that exceeds the established standards (based on a certificate), the applicant can defend the course project once the violations are eliminated and the plagiarism check is re-passed. At most, three inspections of one-course, project are allowed.

Recommendations for students regarding defense preparation. The report's text should be structured to correspond to a five- or ten-minute speech. In the report, it is necessary to reflect: justification of the relevance of the topic, the purpose and tasks of the work, the subject and object of the research, the purpose of the project; structural (or functional) composition of the development; selected tools for architecture development and software design; main characteristics of the developed project; conclusions (brief results of the entire design, their implementation and possible ways of further improvement, use or implementation).

Special attention should be paid to the report's language, which should be clear, competent and confident. This makes the speaker clear and convincing. Violations of the norms of literary pronunciation, for example, the use of incorrect accents in words, etc., are unacceptable. The report should be scientific, reasoned and understandable to the audience of specialists.

When presenting information about the work, one should avoid complex verbal constructions and not overload the presentation with secondary schemes, tables, or graphs that interfere with the perception of the material.

7 EVALUATION CRITERIA

The results of students' attestation are evaluated according to the national four-point scale and the ECTS scale following the "Regulations on control and evaluation of students' educational achievements".

When determining the overall rating, the following components are considered: manager's rating; reviewer assessment; evaluation for the presentation of the work; evaluation for protection of CP; evaluation for the quality of work, etc. In general, the CP evaluation system is based on the following parameters: evaluation of the quality of the content of the explanatory note; assessment of the quality of the explanatory note; assessment of the quality of the software developed by the student; assessment of the quality of CP protection.

Content quality assessment criteria explanatory note:

– correspondence of the content to the topic of the CP;

– conformity of the performed work to the task;

– relevance and perspective of the research topic, its relevance to modern achievements of science and technology, execution to the order of enterprises, its complexity;

– objectivity of coverage of the state of the issue with creative use of information sources (including the use of the latest works of both domestic and foreign specialists);

– scientific novelty, the validity of the proposed solutions;

– practical usefulness of work results (availability of an act of implementation, production approval, etc.);

– reliability of decisions and conclusions;

– the degree of independence of the master's student;

– validity of methods and means of solving the problem;

– the level of project and program solutions and their justification;

– application of modern technologies and programming languages;

– lack of duplication, descriptive material, and stereotypical solutions that do not affect the results' essence.

Criteria for evaluating the quality of design explanatory note:

– conformity of the design of the explanatory note with current standards;

– organic connection of text material with graphics;

– general and professional literacy, brevity and logical sequence of presentation of the material.

Criteria for evaluating the quality of a software product:

– performance and functional suitability of the software;

– compliance of the software tool with the task and specification of requirements;

– software quality attributes (reliability, security);

– simplicity and convenience of the interface.

Criteria for evaluating the quality of CP protection:

– the quality and completeness of the student's report in defence of the CP: content of the report; quality of illustrative material and its presentation; mastery of the material, sequence, logic, style, literacy of the presentation of the material, speech culture; the ability to briefly and accurately reveal the content of the work, to justify the decisions made, to analyze and compare the obtained results, to conclude.

– the correctness and completeness of the student's answers to the questions of the members of the commission: the ability to formulate a reasoned answer to questions, to answer non-standard (problematic) questions, to justify one's position in problematic situations, to demonstrate professional competence, etc.

– an "***excellent***" grade if he completed the CP in its entirety without comments from the supervisor and the reviewer, with adherence to all requirements, and during the defense showed: a competent, logical presentation of the report, correct and complete answers to the questions (incl. part non-standard); deep and complete mastery of the content of the educational material; the ability to connect theory with practice, justify one's judgments, draw conclusions; possession of versatile skills , techniques and competences (which indicates a deep level of assimilation of competences and full mastery of mental operations at all levels – "knowledge", "understanding", "application", "analysis", "evaluation", "synthesis").

The grade "***good***" is assigned to the student if he completed the CP in full, in compliance with the requirements, and during the defence demonstrates a solid knowledge of the material of the work, presents it competently and to the point, does not allow essential inaccuracies in the answers to questions, correctly applies for theoretical positions when solving practical tasks, possesses the necessary skills

and techniques for their implementation, demonstrates an in-depth level of mastery of competencies, performing mental operations at the levels of "knowledge", "understanding", "application", "analysis", "evaluation" and "synthesis".

A "***satisfactory***" grade is given to a student who completed the CP according to the task but made inaccuracies while performing it; during the defence, demonstrated knowledge of the basic educational material in the amount necessary for further professional activity; the master's student has mastered and developed practical skills in the field, mainly copes with the performance of practical tasks, but allows violations of the logical sequence in the presentation of the material, mistakes in answering questions, experiences difficulties when answering questions modified from the survey, demonstrating a threshold level of formation competencies and mastery of mental operations at the levels of "knowledge", "understanding" and "application".

The grade "***unsatisfactory***" is assigned in the case when the student performed the CP poorly and during the defence showed unsystematic knowledge, does not know how to distinguish the main and secondary, makes mistakes in the definition of concepts, distorts their meaning, presents the material chaotically and uncertainly, cannot use knowledge in solving practical tasks (which indicates the formation of professional competences at or below the threshold level).

The weighting factors for evaluating the results of the course project, considering the above criteria, are shown in Table 3.

Table 3 – Weighting factors for evaluating the results of the course project

Meaningful filling of the software and the project	Compliance with requirements and rules design	Adherence to the course work schedule	Protection
0.4	0.2	0.2	0.2

It should be noted that the weighting coefficients may change depending on changes in curricula and work programs.

LIST OF USED RESOURCES

1. Standard of higher education of Ukraine in specialty 121 "Software engineering" for the first (bachelor's) level of higher education. – Kyiv : MES of Ukraine, 2018. – 24 p.

2. About the world-professional program of bachelor's training in the specialty "Software engineering" / KNU website. – URL: https://khmnu.edu.ua/121-ipz-b-op/.

3. Text documents. General requirements of SOU 207.01:2017 / Yu. M. Boyko, G. V. Krasilnikova, L. I. Pershina, T. F. Kasyanchuk. – Khmelnytskyi, 2017. – 45 p.

4. DSTU 3582-97 Abbreviations of words in the Ukrainian language in the bibliographic description. General requirements and rules. – Kyiv : Derzhstandard of Ukraine, 2013. – 25 p.

5. DSTU 3008:2015. Information and documentation. Reports in the field of science and technology. Structure and design rules. – Kyiv, 2016. – 26 c.

6. DSTU 3008-95 Documentation. Reports in the field of science and technology. Structure and registration rules. – Effective 01.01.1996. – Kyiv : Derzhstandard of Ukraine, 1996. – 29 p.

7. Forkun Yu. V. System software architecture. Methodical instructions for the implementation of a course project for students of the "Software Engineering" specialty / Yu. V. Forkun. – Khmelnytskyi : KhNU, 2017. – 44 p.

8. Diploma project: methodological guidelines for its implementation for undergraduate students majoring in "Software engineering" / L. P. Bedratyuk, G. I. Radelchuk, Yu. V. Forkun, O. M. Yashchyna. – Khmelnytskyi : KhNU, 2020. – 79 p.

9. Examples of bibliographic description in the list of used sources taking into account the National Standard of Ukraine DSTU 8302:2015. – URL: https://dri v e.google.com/file/d/1FCoiPjgSlCBQz_Q9PDu1p4a-Dp_QG2Ry/view, https://msu.edu.ua/library/wp-content/uploads/2019/02/pryklady-oformlennja-bibliohrafichnoho-opysu-zhidno-dstu-8302.pdf.

10. Internet programming. Methodical instructions for the implementation of a course project for students of the "Software engineering" specialty / O. M. Yashina, O. G. Onyshko. – Khmelnytskyi : KhNU, 2018. – 67 p.

11. DSTU 3582:2013. Information and documentation. Bibliographic description. Abbreviations of words and phrases in the Ukrainian language. General requirements and rules. – To replace DSTU 3582–97; valid from 2013-08-22. – Kyiv : Ministry of Economic Development of Ukraine, 2014. – 15 p.

12. Regulations on compliance with academic integrity at Khmelnytskyi National University / KhNU website. – URL: https://khmnu.edu.ua/wp-content/uploads/normatyvni-dokumenty/polozhennya/pro-systemu-zabezpechennya-akademichnoyi-dobrochesnosti.pdf.

13. Regulations on control and evaluation of the results of studies of students of higher education at KHNU / Website of KhNU. – URL: https://khmnu.edu.ua/wp-content/uploads/normatyvni-dokumenty/polozhennya/pro-kontrol-i-oczinyuvannya-rezultativ-navchannya.pdf.

APPENDICES

APPENDIX A
(reference)

DESIGN ASSIGNMENT TEMPLATE

Khmelnytskyi National University
Faculty of Information Technologies
Department of Software Engineering
Programme subject area 121 Software engineering
Code, name

APPROVED:
Head of the department _____
_____
"____" _____ 20__ yr.

TASK
for a course project

_____
Last name, first name, patronymic of the student in the genitive case

1 Topic of the course project _____
_____
_____
_____

2 Project implementation period: from _____ to _____

3 Initial data for the project_____
_____
_____
_____
_____

4 Content of the explanatory note (list of questions to be developed)
_____
_____
_____
_____
_____

5 List of graphic material (indicating mandatory drawings)

Calendar plan

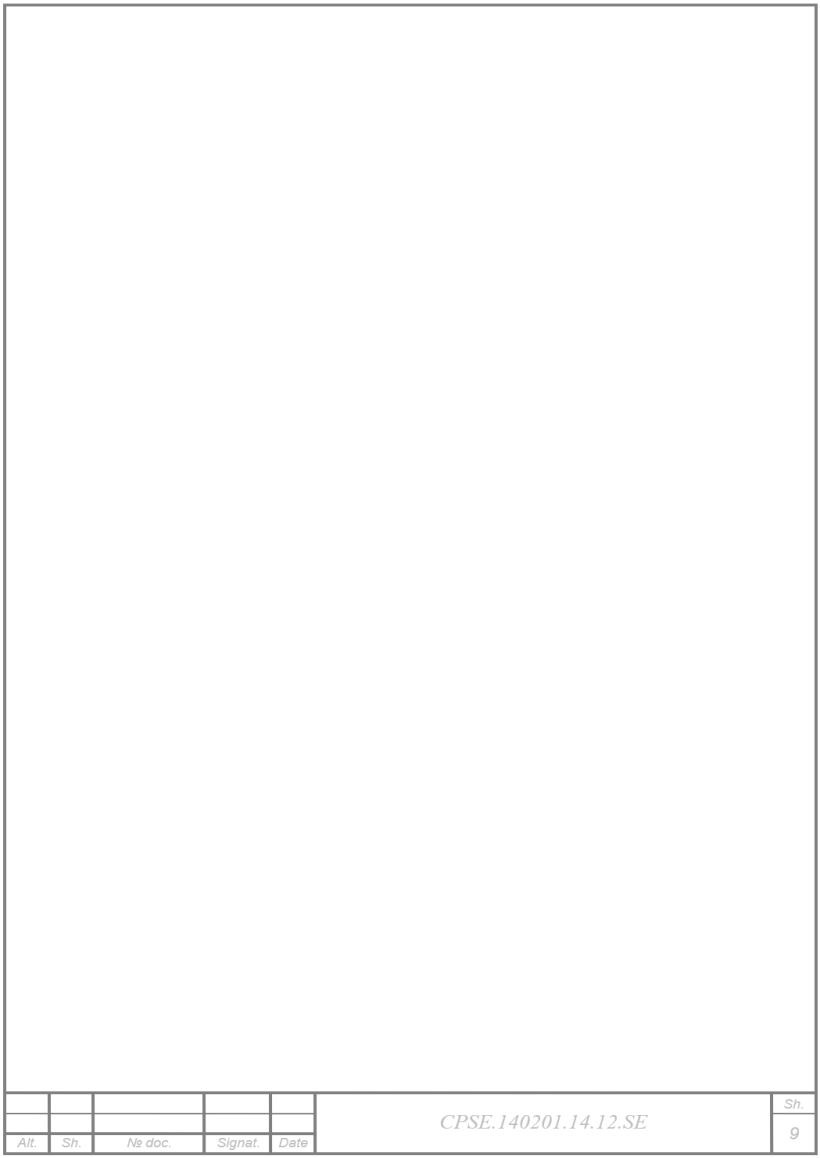
No. z/p	The name of the stages of the course project	The term of execution of the stages of the project	Note

Student _____ _____
Signature Initials, surname

Project Manager _____ _____
Signature Initials, surname

APPENDIX B
(reference)

EXAMPLES OF FRAMES AND THEIR FILLING



					CPSE.140201.14.12.SE	Sh.
Alt.	Sh.	№ doc.	Signat.	Date		9

CONTENT

APPENDIX C
(reference)

AN EXAMPLE OF DESIGN OF THE TITLE PAGE OF A COURSE PROJECT

Khmelnytskyi National University
Department of software engineering

COURSE PROJECT

"Web technologies"
Subjects

on the topic: Online store selling toys

CPSE.140201.14.12.SE
Code, name

Specialty 121 "Software Engineering"
Code, name

Student(s) of the 1st year study, group SEs-23-1 _____ Oleg GORILY
Cipher Signature Initials, last name

Candidate of Technical Sciences, Associate Professor _____ Oksana YASHYNA
Position, academic title, academic degree Signature Initials, surname

Scores _____
Rating on a scale:
national_____/ECTS____

Commission members: _____ _____
Signature Initials, last name
_____ _____
Signature Initials, last name
_____ _____
Signature Initials, last name

Khmelnytskyi, 2024

APPENDIX D
(reference)

EXAMPLES OF BIBLIOGRAPHIC DESCRIPTION IN THE LIST OF USED SOURCES TAKING INTO ACCOUNT THE NATIONAL STANDARD OF UKRAINE DSTU 8302:2015

Source	Design
Books	
One author	Polishchuk V. V. System programming Synopsis of lectures. – Uzhhorod : UzhNU, 2018. 56 p.
Two or three authors	Zayats V. M., Zayats M. M. Logical and functional programming. System approach: textbook. Rivne: NUVHP, 2018. 421 p.
Four and more authors	1. Fundamentals of labor protection: a textbook / O. I. Zaporozhets etc. 2nd edition. Kyiv : TsUL, 2016. 264 p. 2. Higher mathematics: summary of lectures / Tkachuk T.S. etc. Kyiv, 2015. 82 p.
Without an author	1. Scientific and practical commentary on the Civil Code of Ukraine / according to general ed. T. A. Tarnavskyi. Kyiv : TsUL, 2016. 186 p. 2. Anthology of Ukrainian literary and critical thought of the first half of the 20th century / edited by V. Ageeva. Kyiv : Smoloskip, 2016. 904 p.
Legislative and regulatory documents	1. Constitution of Ukraine: official. text. Kyiv : KM, 2015. 98 p. 2. On education: Law of Ukraine dated September 5, 2017 No. 2145-VIII. Voice of Ukraine. 2017. September 27 (No. 178-179). C. 10–22. 3. On higher education: Law of Ukraine dated July 1, 2014 No 1556-VII. Date of update: 09/28/2017. URL: http://zakon2.rada.gov.ua/laws/show/1556-18
Standards	DSTU ISO 6107-1:2004. Water quality. Dictionary of terms. Part 1 (ISO 6107-1:1996, IDT). [Effective from 2005-04-01]. Kind. officer Kyiv : Derzhspozhivstandard of Ukraine, 2006. 181 p.
Electronic resources	Ukraine through the eyes of children: a photo exhibition. URL: http://www.kmu.gov.ua/control/uk/photogallery/gallery?galleryId=15725757& (access date: 11/15/2017). 2. Khmil A. A. Functions of the state service according to the legislation of Ukraine // Legal scientific electronic journal. 2017. No. 5. P. 115–118. URL: http://lsej.org.ua/5_2017/32.pdf . 3. Khmil I. O. Ways to overcome legal nihilism in Ukraine. Bulletin of Zaporizhzhya National University. Legal sciences. Zaporizhzhia, 2016. No. 3. – pp. 20–27. – URL: http://ebooks.znu.edu.ua/files/Fakhovydannya/vznu/juridichni/VestUr20 15v3/5.pdf. (date of application: 11/15/2017).

APPENDIX E
(reference)

CONTENT

APPENDIX F
(reference)

SAMPLE DESIGN OF ABBREVIATIONS AND CONDITIONAL MARKS

LIST OF ABBREVIATIONS AND TERMS

PI	–	Internet programming
SE	–	Software engineering
DB	–	Database
computer	–	electronic computing machine
EC	–	expert system
IT	–	Information Technology
CS	–	computer systems
LM	–	local network
MPS	–	microprocessor system
OOP	–	object-oriented programming
software	–	Software
DBMS	–	database management system
SHI	–	artificial intelligence system
API	–	Application programming interface
CMS	–	Content Management System
DBS	–	Database Server
MMS	–	Multimedia Card
SMB	–	Server Message Block
UML		Unified Modeling Language
WWW	–	World Wide Web
XML	–	extensible Markup Language

APPENDIX G

AN EXAMPLE OF A TECHNICAL TASK

1 Introduction

The name is a knowledge control test system for students of the Khmelnytskyi National University.

Brief description: IS is intended for students of Khmelnytskyi National University to obtain an assessment of their knowledge.

The field of IS application is its use as a fully functional software complex for knowledge control by students of Khmelnytskyi National University.

2 Basis for development

The development of this project is carried out on the basis of the task for the development of a course project in the discipline "Web technologies" (the name of the discipline corresponds to the name of the discipline in which the educational practice is conducted).

This IS is implemented as part of a course project on the topic "Test system of knowledge control for students of Khmelnytskyi National University".

3 Purpose of development

The project aims to develop a computerized testing system to control students' acquired knowledge, skills and abilities.

Let us indicate the functional and operational purpose of the complex system under development:

1 Functional purpose: analysis of acquired knowledge, skills and abilities by students of Khmelnytskyi National University.

2 Operational purpose: the complex system can be used on all computers of the units of the educational institution that meet the minimum requirements for software and hardware for the normal functioning of the application

4 Requirements for the software product

When implementing and using statistics for testing students' knowledge, requirements for functional characteristics, project reliability, operating conditions, composition and parameters of technical means, hardware and software compatibility must be taken into account.

4.1 Requirements for functional characteristics

IS should provide the following capabilities:

– the objectivity of the assessment, since the influence of subjective factors (for example, such as the examiner's awareness of the current academic performance, the accounting of his behavior in educational classes, etc.) is excluded in the test control;

– reliability of information about the amount of material learned and the level of its assimilation;

– efficiency – a large number of students can be tested at the same time, and the results can be checked much easier and faster than with traditional control;

– reliability – the test assessment is unambiguous and reproducible;

– differentiation of training – since the tests will contain tasks of different levels;

– the implementation of an individual approach in education – individual verification and self-examination of knowledge is possible;

– comparability of test results for different groups of students studying in different programs, using different methods and organizational forms of education.

IS should provide the following opportunities to the teacher and administrator:

– provide statistical data of the student;

– perform analysis of statistical data with the calculation of the student's overall rating;

– formation of a list of low-quality students (black list) based on the analysis of the performance of test tasks;

4.2 Reliability requirements

The system must meet the following reliability requirements:

– support functions of protection against unauthorized access (separation of access rights to database information for system users);

– process erroneous actions of the user and inform him about it;

– exclude emergency situations that may directly or indirectly lead to damage to the hardware, software or informational components of the user's environment.

4.3 Terms of use

The operating conditions must comply with the sanitary and technical standards for the operation of computer equipment. Only specially trained administrators, teachers or developers are allowed to maintain the system.

The operating conditions are as follows:

– ambient air temperature +5 – +30 0C;

– relative humidity for selected types of data carriers, not exceeding the norm (45–60 %);

– availability of qualified personnel.

4.4 Requirements for the composition and parameters of technical means

The minimum requirements for software and hardware for the normal functioning of the software product are presented in Table G.1

Table G.1 – Software and hardware requirements

Name	Characteristic
Processor	Intel Pentium III 600 and above
Operating device that remembers	128Mb and more
Operating System	Windows
Monitor	SVGA extension 1024x768
Hard disk capacity	free space at least 1 Gb
Keyboard	Genius KB–06 PS/2 — PS/2 connector; 104 cl. + 3 energy saving; cable 1.3 m
Manipulator "Mouse"	Genius Net Scroll+ PS/2 oem — PS/2 connector; 2 buttons + scrolling button; cable 1.4 m
Network map	The speed is at least 10 Mb/s

4.5 Information and software compatibility requirements

The means of implementation is Piton, because Piton is one of the most powerful systems that allow you to create both individual application programs and branched complexes designed to work in corporate networks and the Internet at the most modern level.

5 Requirements for software documentation

The preliminary composition of the program documentation is established in accordance with the DSTU and the Unified System of Program Documentation. Below is a list of program documents and their content:

– structural scheme of the system;

– program text – program recording with necessary explanations and comments;

– description of the program – information about the logical and physical model, information about the functioning of the program;

– program and test methodology – requirements to be checked during program testing, as well as control procedure and methods;

– technical task - this document;

– explanatory note – scheme of the algorithm, general description of the algorithm or the functioning of the program, as well as justification of the adopted technical and technical and economic decisions;

– operational documents – instructions for the administrator, manager and carrier.

6 Stages and stages of development

The development of a software product goes through several stages and stages, which are presented in Table G.2.

Table G.2 – Stages and stages of development of PP

Stages of development	Stages of work	Content of works
Technical task 01.09.24.– 17.09.24	Justification of the need to develop the program	A brief description of the testing organization software; basis and purpose of development; requirements for the software complex and documentation; stages and stages of program development; order
Research works		
	Development and approval of the technical task	Control and acceptance
Draft project 09.10.24 – 09.10.24	Development of a sketch project	Preliminary development of the structure of input and output data; clarification of the programming environment; development and description of the general algorithmic structure of the developed program

End of table G.2

Approval of the draft project		
Technical project 03.10.24–14.10.24	Development of a technical project	Clarifying the structure of input and output data, determining the form of their representation; development of a detailed algorithm; development of the program structure; final determination of the configuration of technical means; development of measures for the implementation of the software complex
Approval of the technical project		
Working project 17.10.24.–24.10.24.	Program development	Implementation of the software complex for testing students' knowledge; debugging; development of testing methods; conducting preliminary tests (testing); software adjustment; documentation development
Development of software documentation		
Testing the program		
Implementation 25.11.24–01.12.24	Preparation and transfer of the program.	Preparation and transfer of the software package; staff training in the use of the software complex; making adjustments to the software and documentation

7 Control and acceptance procedure

The control is carried out by the system's end users connected during the system testing phase.

Reception of the complex is carried out after its complete installation and customization for specific users and a short course on training users.

After the completion of the development of the system, the following types of tests must be conducted: testing for protection against incorrect input; testing the completeness of information exchange between different applications.

APPENDIX K

EXAMPLES OF STRUCTURAL PARTS OF THE COURSE PROJECT

Introduction

Today, most of people work with the help of a computer, which is much simpler. Computers have become widely used in various spheres of human activity. The computer is also used to develop software and Web resources.

This project will develop a software system that will be used during the workflow of a family medicine clinic. With the help of this software, users will be able to learn more about medicine, that is, the system will provide an opportunity to view certain news of a medical nature, the introduction of new reforms in this field and the conditions of their operation. Users will also be able to communicate with dispensary employees using online chat (messages can be both private and public).

The relevance of this topic lies in the fact that in many organizations, some resources are transported to their customers. In order to profitably transport these resources, employees develop transportation plans. It takes a lot of time, so it will be relevant to develop a program that will replace this work of employees and save their time.

The purpose of the developed software product will be to create software that will simplify the search for some necessary medical information. The software product must be in the form of a web resource belonging to a family medicine clinic. Also, the future software system should provide its users with certain information about the employees of this medical institution.

Therefore, the main task of the chosen topic of the course project will be the development of software that will implement the reference and information system of the outpatient clinic of family medicine.

The object of software research is the work process of a family medicine outpatient clinic.

The subject of the research is the software, which is an analogue of the reference and information system of the outpatient clinic of family medicine.

1. Study of the subject area and analysis of the requirements for the software system

1.1 Comprehensive analysis and description of the subject area, its structural and functional features

Recently, many types of work in global production and other spheres of human activity have become as automated as possible, and over the past few years it has been seen that the automation of these works is implemented with the help of web resources. In this way, many social projects have been implemented that make it easier for people to search for certain information sources and everything that comes from these sources. For the most part, the results of the development of web

resources by programmers can be seen using the most popular systems, such as: the site of education, law enforcement agencies, the Supreme Council, medical sites, etc.

The task of this course project is the development of a web system that is specifically related to medicine. Today, such a science as medicine is quite automated. Each link in the hierarchy of the organization of medical institutions (that is, each hospital) uses computer technologies, which leads to easier work.

Medicine is a field of scientific and practical activity that studies normal and pathological processes in the human body, various diseases, pathological conditions, methods of their treatment, prevention and strengthening of human health.

The following types of medicine are distinguished:

– theoretical medicine (synonyms: medical science, medical theory) is a branch of science that studies the human body, its structure and functioning in a normal state and in various pathological conditions, methods: experiment, diagnosis, treatment and prevention (prevention) of such conditions. Theoretical medicine is divided into medical sciences, each of which studies separate aspects of theoretical medicine;

– practical medicine (synonyms: medical practice, health care, clinical medicine) – a field of activity that applies the acquisitions of medical science in practice;

– evidence-based medicine (medicine based on evidence) is a set of methodological approaches to clinical research, evaluation and application of their results.

The development of medicine has never stopped, as with the appearance of new diseases, there is a need for new methods of treatment and new drugs. Moreover, precisely for this development, its correct organization is needed, which is what the medical (Ministry of Health of Ukraine) and the political government do. Recently, the Ministry of Health has issued many medical reforms which certify that there should be special institutions of family medicine within the state - outpatient clinics headed by a family doctor. Hence the name "Family Medicine". Family medicine is a complex of scientific and practical activities for the organization of family medical practice. Family medical practice must be considered as one that provides long-term care for the health of a citizen and all members of his family, regardless of the nature of the disease, the state of the organs and systems of the body in all periods of a person's life. Family medical practice is based on the principles of evidence-based medicine.

In 2018, a new reform was introduced in the world of medicine, consisting of four implementation stages. Its conditions entail a list of changes in primary medicine. The main points are that each family doctor must sign special declarations with patients stating that he is their doctor and that he can only be paid as a result of their treatment. The treatment processes of his patients should be recorded by accounting systems. Also, each institution of family medicine has the right to change paper outpatient charts of patients to electronic ones. Therefore, for the convenience and speed of work of such institutions and their family doctors, it is necessary to use computer technologies and special software.

Each of the types of medicine listed above carries its own theory, research and treatment methods. Therefore, the automation of medicine differs depending on its type. And since family medicine is currently the most popular and in demand, the automation of medical clinics is the most expedient.

1.2 Analysis of software and technical support of the subject area

Today, there are many software products related to medicine, namely various medical institutions. Some of them are not perfectly developed since the assumed requirements for the software product are not fully implemented or the systems differ in their function. A list of already existing web systems was defined to compare the requirements and determine those that need to be implemented in our future software product. Therefore, the following sites were taken for the requirements analysis:

– the website of the local medical institution of the Dnipro district of the city of Kyiv;

– website of the central district hospital of the city of Vasylkiv, Kyiv region;

– Medix is a globalized medical site of Ukraine.

The first analogue of the software system, a reference and information application for the medical clinic, is a web service attached to the medical institution named "Primary Health care centre No. 1 of the Dnipro district of the city of Kyiv".

Let's take a closer look at the software system of this web resource. Using this site, the user can view various medical news, the composition of the institution's medical staff, the list of services provided by this institution, information about the institution itself, and use the system's forum. The site has an attractive appearance.

The result of the analysis of this site is a list of its advantages and disadvantages. And therefore the advantages are as follows:

– information about the institution's employees;

– the list of services provided by the medical institution;

– forum;

– list of news.

Among the disadvantages, the following can be noted:

– it is not possible to communicate with the doctor using personal messages;

– it is not possible to make an appointment with a doctor;

– there are no contacts of the institution, except for the phone number.

The second analogue to the future software product, which can be analyzed to determine the requirements for our system, is a web resource attached to a medical institution, the name of which is "Vasylkiv Central District Hospital".

Upon completing the analysis of this web resource, a synthesis of the results of this analysis was carried out, i.e., as in the analysis of the first site, a list of advantages and disadvantages of the web system was compiled. The advantages is the functionality of the system, which allows you to view the following:

– history of the hospital;
– doctor's appointment schedule;
– the list of branches of the institution;
– medical news;
– forum (and use it);
– contacts of the institution and all its branches;
– photo of the hospital.

Among all the shortcomings, only one minor drawback can be singled out – it is impossible to make an appointment with a doctor using the online system.

The next (third) analogue to our future software is a site that unites all medical institutions in Ukraine and their employees. That is why it is not attached to any particular medical institution.

This system provides a significant number of opportunities to the user, which are its advantages, such as:

– search for the right doctor using special filters;
– search for the right medical facility;
– the possibility of writing a review about this or that doctor, or about the institution as a whole;
– the list of services provided by the medical institutions specified in the system and the price list for these services (depending on the status of the institution – private or state);
– the site is adaptive, i.e. multi-browser.

It's impossible to mention significant drawbacks since the website functions correctly, and query execution happens quickly.

Having analyzed these three analogues to our future reference and information system, it is reasonable to conclude that each has the same requirements. However, they still need to be fully implemented, although the resources are fully operational. Comparing the results of analyses of these analogues, most of their benefits are similar or even the same. Based on this, you can create a list of requirements for our future web system using the requirements for these analogues.

1.3 Definition of functional and non-functional requirements for software

This course project aims to develop a reference and information system for a medical clinic. The result of this development should be a fully functional software product that is a web resource. It must meet the requirements for determining which analysis of the subject area and analogues of our future software was carried out. The requirements themselves are divided into two sections: functional and non-functional.

Usually, when conducting the necessary analyses for future software, non-functional requirements are determined first. Non-functional requirements are software requirements that set criteria for evaluating the quality of its work and determine what the system should be. According to non-functional requirements, the system should contain:

– attractive appearance;

– a design favorable to human vision;

– template files that will be connected to the main site presentation files;

– menu and sub-menu of the site;

– header and footer on each web page;

– cross-browser design.

Let us analyze the listed non-functional requirements in more detail.

Usually, web resources consist of pages containing the same components (widgets) and their description is duplicated on each page. Therefore, it is advisable to create template files that describe the code of these components only once and connect to the required web pages with the help of special commands. This requirement can be applied when creating a visual container for web components, such as a site menu. This container should consist of buttons or stylized links, with the help of which the transition from one web page to another will be carried out. You also need to add a submenu to those files, where it will be appropriate, or add it to the site's main menu.

Each page of the site must be styled using cascading style sheets of the CSS3 version and described in the HTML5 page markup language. The content of the pages should consist of:

– site headers (pages);

– content, where the necessary information will be displayed;

– the side panel, where the visual container from the site menu will be placed;

– basement;

– some other components can be added to improve the page design.

The next phase of requirements analysis for our future software is establishing functional requirements. Functional requirements are software requirements that describe the internal workings of the system, its behavior: data calculation, data manipulation, data processing, and other specific functions that the system must perform. According to the functionality requirements, the system should contain the following:

– information about the medical institution to which this web system will belong;

– displaying a list of hospital staff;

– displaying information about hospital employees on a separate web page;

– presentation with a list of certain medical articles and viewing each article on a separate page;

– display of news lists, according to the specified category, as well as individual viewing of each news item;

– pages for working with your own information, i.e. user registration in the system, his authorization.

Let's consider these functional requirements in more detail. The site must contain at least one page containing information about the institution to which it belongs. It should also be possible to edit these data, as they tend to change their content. Among these data, it is advisable to indicate the coordinates of the institution, the means of communication with the head (s), and the data by which this communication can be made. The following is one of the main stages of the system, which presents news of a medical nature. The site should provide the ability to add, edit and delete news. These operations must be performed by a specially designated user or an administrator. Other users should be provided with a list of these news items.

Also, this functionality can be used to organize work with articles, as the corresponding section has an almost exactly similar structure. The difference between articles and news should be that articles are stored in one list, while news is divided into categories.

Another point that is no less important is the institution's staff. The site should provide users with the opportunity to view lists of employees of the institution by selecting from the appropriate link. This means that each level of the personnel hierarchy will be displayed separately and the user will have to select this level using a special menu.

Based on the above requirements, it can be noted that the site must be implemented using PHP programming language technologies using the MVC design template, as this template is very popular in modern web development.

Therefore, the future software product should be a web resource that will have an attractive appearance, as well as be logically understandable to the user and easy to use.

1.4 Development of the technical task

Developing a software product is a large project with a list of the specified works. An integral part of this list is developing the technical task for this software product. The technical task is a document in which the main development goals and requirements for the software product are formulated, the terms and stages of development are defined, and the process of receiving and transferring research is regulated. Also, this document may contain advantages and disadvantages of the software product.

The terms of reference for our future software are in Appendix A.

CONTENT