Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Department of Computer Systems Software

Components of Software Engineering. Part 1. Introduction to Software Engineering

Work program of the discipline (Syllabus)

Details of the discipline	
Level of higher education	***First (bachelor's)***
Field of knowledge	*12 Information Technology*
Speciality	*121 Software engineering*
Educational program	*Software Engineering of Multimedia and Information Retrieval Systems*
Discipline status	*Regulatory*
Form of study	*Full-time (full-time)*
Year of preparation, semester	*1 year of preparation, 2 semester*
Scope of discipline	*Lectures: 36 hours, laboratory work: 18 hours, individual work: 66 hours.*
Semester control / control measures	*Credit, modular test, calendar control*
Timetable	*According to the schedule for the spring semester of the current academic year (rozklad.kpi.ua)*
Language of instruction	*English*
Information about Course Leader / Instructors	Lectures and laboratory classes are conducted by: *Doctor of Philosophy, Assistant Dychka A.I., andriydychka@gmail.com*
Course Placement	*Electronic campus of NTUU "KPI". Materials on the discipline "Introduction to Software Engineering"*

The program of the discipline

1. Description of the discipline, its purpose, subject of study and learning outcomes

Study of the credit module "Components of Software Engineering. Part 1. Introduction to Software Engineering" is aimed at forming the basic competencies necessary for students to solve practical problems of professional activity related to software engineering.

***The purpose** of studying the credit module "Components of Software Engineering. Part 1. Introduction to Software Engineering" is the formation of students' basic elements of the ability to independently design and develop software, in particular applications for Android and iOS operating systems, web applications, etc., which will be developed as part of the study of subsequent credit modules of the discipline "Components of Software Engineering".*

***The subject** of the credit module is "Components of Software Engineering. Part 1. Introduction to Software Engineering" is a technology for designing and developing software.*

*The study of the discipline "Components of Software Engineering" forms students' **general competencies (GC) and professional competencies (PC)** necessary to solve practical problems of professional activity:*

***GC02** Ability to apply knowledge in practical situations.*

***PC01** Ability to identify, classify and formulate software requirements.*
***PC02** Ability to participate in software design, including modelling (formal description) of its structure, behaviour, and functioning processes.*
***PC03** Ability to develop architectures, modules and components of software systems.*

PC04 *Ability to formulate and implement software quality requirements in accordance with customer requirements, specifications and standards.*
PC05 *Ability to adhere to specifications, standards, rules and recommendations in the professional field when implementing life cycle processes.*
PC07 *Knowledge of data information models, ability to create software for data storage, extraction and processing.*
PC10 *Ability to accumulate, process and systematize professional knowledge regarding the creation and maintenance of software and the recognition of the importance of a lifelong learning.*
PC11 *Ability to implement phases and iterations of the life cycle of software systems and information technologies based on appropriate software development models and approaches.*
PC12 *Ability to carry out the system integration process, apply change management standards and procedures to maintain the integrity, overall functionality and reliability of the software.*
PC13 *Ability to reasonably choose and master software development and maintenance tools.*
PC16 *Ability to develop software of information retrieval systems.*
PC17 *Ability to develop software of multimedia systems.*
PC19 *Ability to identify, analyze, and document software requirements for multimedia and information retrieval systems.*
PC20 *Ability to create innovative start-up projects, calculate the main technical and economic indicators and develop business models of innovative start-up projects for the development of software for multimedia and information retrieval systems that have commercial potential for investment.*

Program learning outcomes (PLO) *for the discipline "Components of Software Engineering" according to the educational program:*
PLO01 *To analyze, purposefully search for and select the information and reference resources and knowledge necessary for solving professional tasks, taking into account modern achievements of science and technology.*
PLO03 *To know the main processes, phases and iterations of the software life cycle.*
PLO04 *To know and apply professional standards and other regulatory documents in the field of software engineering.*
PLO06 *Ability to choose and use a software development methodology appropriate to the task.*
PLO07 *Know and apply in practice the fundamental concepts, paradigms and basic principles of the functioning of linguistic, instrumental and computing tools of software engineering.*
PLO08 *To be able to develop a human-machine interface.*
PLO09 *To know and be able to use methods and tools for collecting, formulating and analyzing software requirements.*
PLO10 *To conduct a pre-project survey of the subject area, system analysis of the design object.*
PLO11 *To choose the initial data for design, guided by formal methods of describing requirements and modelling.*
PLO12 *To apply efficient approaches to software design in practice.*
PLO13 *To know and apply methods of developing algorithms, designing software, data and knowledge structures.*
PLO14 *Apply in practice tools for software domain analysis, design, testing, visualization, measurement and documentation of software.*
PLO15 *Reasonably choose programming languages and development technologies to solve the tasks of creating and maintaining software.*
PLO16 *To have skills in team development, approval, design and release of all types of software documentation.*
PLO17 *To be able to apply methods of component software development.*
PLO18 *To know and be able to apply information technologies for data processing, storage and transmission.*
PLO19 *To know and be able to apply software verification and validation methods.*
PLO20 *To know approaches to evaluation and quality assurance of software.*

PLO22 *To know and be able to apply project management methods and tools.*
PLO23 *To be able to document and present the results of software development.*
PLO28 *To be able to develop business models and create innovative start-up projects for the development of software for multimedia and information retrieval systems, which have commercial potential for investment.*
PLO29 *To know and be able to manage software creation and implementation projects according to SWEBOK, PMBOK, BPMCBOK international standards.*

2. Prerequisites and post-requisites of the discipline (place in the structural and logical scheme of training in the relevant educational program)

Successful study of the credit module "Components of Software Engineering. Part 1. Introduction to Software Engineering" is preceded by the study of the discipline "Fundamentals of Programming" of the curriculum for bachelors in the specialty 121 Software Engineering.
Obtained during the mastering of the credit module "Components of Software Engineering. Part 1. Introduction to Software Engineering" theoretical knowledge and practical skills ensure the successful implementation of course and diploma projects in the specialty 121 Software Engineering. Also, the acquired knowledge and skills are a prerequisite for the successful mastering of other credit modules in the discipline "Components of Software Engineering" of the curriculum for bachelors in the specialty 121 Software Engineering.

3. The content of the discipline

Credit module "Components of Software Engineering. Part 1. Introduction to Software Engineering" involves the study of the following topics:

Topic 1. The Historical Aspect of Software Engineering

Topic 2. Fundamentals of Software Development Methodology

Topic 3. Fundamentals of Software Requirements Analysis

Topic 4. Fundamentals of Software Architecture and Design

Topic 5. Modern approaches to software development

Topic 6. Documenting the software

Topic 7. Fundamentals of Quality Assurance and Software Testing

Topic 8. Fundamentals of Software Project Management

Topic 9. Software Maintenance

Modular test

Passed

4. Training Materials & Resources

Basic literature:

1. Educational and methodological materials on the discipline "Components of software engineering. Part 1. Introduction to Software Engineering" on the Microsoft Teams platform. Access is provided to registered users.

Further reading:

2. Norman K.L. Cyberpsychology: An Introduction to Human-Computer Interaction. Cambridge: Cambridge university press. 2017. 437 p.
3. Tanenbaum S., Steen M. Distributed systems: principles and paradigms. New York: Prentice Hall, 2006 686 p.

4. Lister T., DeMarco T. Peopleware: Productive Projects and Teams. London : Addison-Wesley Professional. 2013. 272 p.
5. Characteristics of Software Quality/ B. W. Boehm, J.R. Brown, H. Kaspar, M. Lipow, G. J. MacLeod and M. J. Merritt. Lincoln: University of Nebraska-Lincoln. 2013. 206 p.
6. Monson-Haefel R., Burke B. Enterprise JavaBeans. O'Reilly Media, Inc. 2006. 768 p.
7. Cockburn A. Writing Effective Use Cases. London: Addison-Wesley. 2001. 113 p.

Educational content

5. Methods of mastering the discipline (educational component)

Salary No.	*Type of training session*	*Description of the training session*
1	*Lecture 1.*	*Introduction to the fundamentals of programming engineering.* *Tasks for the SRS: p.6 No 1.*
2	*Lecture 2.*	*Overview of software lifecycle processes.* *Tasks for the SRS: p.6 No 2.*
3	*Laboratory work 1 (Part 1)*	*Git technology.* *Tasks for the SRS: p.6 No 3.*
4	*Lecture 3.*	*How to start a new team project.* *Tasks for the CPC: p.6 No 4.*
5	*Lecture 4.*	*Software Business Analysis. Software Tasks* *Tasks for the SRS: p.6 No 5.*
6	*Laboratory work 1 (Part 2)*	*Git technology.* *Tasks for the SRS: p.6 No 6.*
7	*Lecture 5.*	*Software Business Analysis. Software Tasks* *Tasks for the SRS: p.6 No 7.*
8	*Lecture 6.*	*Agile, Scrum, Jira, Confluence.* *Tasks for the SRS: p.6 No 8.*
9	*Laboratory work 2 (part 1).*	*Investigation of the types of requirements, their identification, specification and documentation.* *Tasks for the SRS: p.6 No9.*
10	*Lecture 7.*	*Різниця між Product Owner, Product/Project Manager, Business analyst.* *Tasks for the SRS: item 6 No 10.*
11	*Lecture 8.*	*Software design, principles of software architecture.* *Tasks for the SRS: p.6 No11.*
12	*Laboratory work 2 (part 2).*	*Investigation of the types of requirements, their identification, specification and documentation.* *Tasks for the CPC: p. 6, No. 12.*
13	*Lecture 9.*	*Software design: OOP, Interfaces, composition over inheritance, Loose Coupling & High Cohesion.*

		Tasks for the CPC: item 6 No 13.
14	*Lecture 10.*	*Key principles of UX\UI design. UX Design Key Principles.* *Tasks for the SRS: p. 6, No. 14.*
15	*Laboratory work 3.*	*User interface design. Figma tool.* *Tasks for the SRS: p. 6, No. 15.*
16	*Lecture 11.*	*Trends and prospects for the development of Java.* *Tasks for the SRS: p. 6, No. 16.*
17	*Lecture 12.*	*Web application concept.* *Tasks for the CPC: p. 6, No. 17.*
18	*Laboratory work 4 (part 1).*	*Code refactoring. Java Development, iOS, Android.* *Tasks for the SRS: p. 6, No. 18.*
19	*Lecture 13.*	*Web application concept.* *Tasks for the SRS: p. 6, No. 19.*
20	*Lecture 14.*	*Quality Assurance Strategies and Procedures. Technology Assessment* *Tasks for the SRS: p. 6, No. 20.*
21	*Laboratory work 4 (part 2).*	*Code refactoring. Java Development, iOS, Android.* *Tasks for the CPC: p. 6, No. 21.*
22	*Lecture 15.*	*Quality Assurance Strategies and Procedures. Quality Assurance* *Tasks for the SRS: p. 6, No. 22.*
23	*Lecture 16.*	*Software Performance Testing.* *Tasks for the SRS: p. 6, No. 23.*
24	*Laboratory work 5.*	*Development of software documentation.* *Tasks for the CPC: p. 6, No. 24.*
25	*Lecture 17.*	*Project Management, Delivery Management, Project Tasks.* *Tasks for the SRS: p. 6, No. 25.*
26	*Laboratory work 6.*	*Project planning and resource management of a software development project. Sitecore Experience Management System.* *Tasks for the CPC: p. 6, No. 26.*
Modular test		

6. Independent work of a student/graduate student

Credit module "Components of Software Engineering. Part 1. Introduction to Software Engineering" is based on independent preparation for classroom classes on theoretical and practical topics.

Salary No.	*Name of the topic to be submitted for self-study*	*Number of hours*	*Literature*

1	*Preparation for Lecture 1*	*1*	*1*
2	*Preparing for Lecture 2*	*1*	*1*
3	*Preparation for Laboratory Work 1 (Part 1)*	*4*	*1*
4	*Preparation for Lecture 3*	*1*	*1*
5	*Preparation for Lecture 4*	*1*	*1*
6	*Preparation for Laboratory Work 1 (Part 2)*	*4*	*1*
7	*Preparation for Lecture 5*	*1*	*1*
8	*Preparation for Lecture 6*	*1*	*1*
9	*Preparation for Laboratory Work 2 (Part 1)*	*4*	*1*
10	*Preparation for Lecture 7*	*1*	*1*
11	*Preparation for Lecture 8*	*1*	*1*
12	*Preparation for laboratory work 2 (part 2)*	*4*	*1*
13	*Preparation for Lecture 9*	*1*	*1*
14	*Preparing for Lecture 10*	*1*	*1*
15	*Preparation for laboratory work 3*	*4*	*1*
16	*Preparing for Lecture 11*	*1*	*1*
17	*Preparing for Lecture 12*	*1*	*1*
18	*Preparation for laboratory work 4 (part 1)*	*4*	*1*
19	*Preparation for Lecture 13*	*1*	*1*
20	*Preparation for Lecture 14*	*1*	*1*
21	*Preparation for laboratory work 4 (part 2)*	*4*	*1*
22	*Preparing for Lecture 15*	*1*	*1*
23	*Preparation for Lecture 16*	*1*	*1*
24	*Preparation for laboratory work 5*	*4*	*1*
25	*Preparation for Lecture 17*	*1*	*1*
26	*Preparation for laboratory work 6*	*4*	*1*
27	*Preparation for the modular test*	*8*	*1*
28	*Preparation for the test*	*5*	*1*

Policy & Control

7. Academic discipline policy (educational component)

Attending classes. *Absence from the classroom does not imply the accrual of penalty points, since the final rating score of the student is formed solely on the basis of the assessment of learning outcomes. At the same time, discussion of the results of thematic tasks, as well as presentation/public speaking and participation in discussions and additions to seminars will be evaluated during classroom sessions. For active participation in the work of the seminar, the student prepares according to the recommendations of the teacher for a certain seminar Literature classes. Participation in the seminar also involves the preparation of reports and co-reports within all classes.*

Missed assessment controls. *Each student has the right to make up for classes missed for a valid reason (sick leave, mobility, etc.) through independent work. More details at the link https://osvita.kpi.ua/node/39;*

Procedure for appealing the results of control assessment measures. *The student may raise any question that relates to the control procedure and expect it to be dealt with in accordance with predetermined procedures. Students have the right to reasonably challenge the results of control measures, explaining which criterion they do not agree with in accordance with the evaluative. Calendar control is carried out in order to improve the quality of students' education and monitor the student's compliance with the requirements of the syllabus.*

Academic integrity. *The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Read more: https://kpi.ua/code .*

Norms of ethical behavior. *The norms of ethical behavior of students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Read more: https://kpi.ua/code .*

Inclusive education. *The acquisition of knowledge and skills during the study of the discipline "Research Activities in Computer Engineering" may be available to most persons with special educational needs, except for applicants with severe visual impairments who do not allow them to perform tasks using personal computers, laptops and / or other technical means.*

Teaching in a foreign language. *Students may be encouraged to refer to English-language sources in the course of their assignments.*

Academic Integrity Policy*. All written works are checked for plagiarism and are allowed to be defended with correct textual borrowings of no more than 20%. The use of any sources of information during tests is prohibited (including the use of mobile devices).*

8. Types of control and rating system for assessing learning outcomes (CRO)

During the semester, students complete 6 laboratory work. Maximum number of points for each laboratory company: 10 points.

Points for ***laboratory work*** *are awarded for:*
- quality of laboratory work: 0-4 points;
- answer during the defense of laboratory work: 0-2 points;
- performance of the laboratory report: 0-2 points;
- Timely submission of the work for defense: 0-2 points.

Criteria for evaluating the quality of performance:
4 points – the work is done qualitatively, in full;
3 points – the work was done qualitatively, in full, but has shortcomings;
2 points – the work was completed in full, but contains minor errors;
1 point – the work was completed in full, or contains significant errors;
0 points – the work was not completed in full.

Criteria for evaluating the response:
2 points – the answer is complete, well-reasoned;
1 point – in general, the answer is correct, but has flaws or minor errors;
0 points – there is no answer or there are significant errors in the answer.

Evaluation criteria for the report:
2 point – the report was completed in full;
0-1 points – the report is missing or there are significant shortcomings in the report.

Criteria for assessing the timeliness of submission of the work for defense:
2 points – the work is submitted for defense no later than the specified period;
0 points – the work is submitted for defense later than the deadline.

Maximum number of points *for the completion and defense of laboratory work:*

10 points × 6 lab. works = 60 points.

*The task for **the modular test** consists of 3 questions – 2 theoretical and 1 practical. The answer to each theoretical question is worth 10 points, and the answer to the practical task is worth 20 points.*

Evaluation criteria for each theoretical question of the test:
10 points – the answer is correct, complete, well-reasoned;
8-9 points – the answer is correct, detailed, but not very well argued;
6-7 points – in general, the answer is correct, but has flaws;
4-5 points – there are minor errors in the answer;
1-3 points – there are significant errors in the answer;
0 points – no answer or the answer is incorrect.

Criteria for evaluating the practical task of the test:
18-20 points – the task was completed correctly, a full thorough explanation of the selected solutions for the task was provided;
14-17 points – the tasks and explanations of the selected solutions are completed at the basic level, but not all features are taken into account;
9-13 points – the performance of the task and/or the reasoning of the selected solutions contains a number of inaccuracies or there is no reasoning for the decisions;
5-8 points – significant mistakes were made during the task, leading to a false result;
1-4 points – the task has been started, but the correct answers have not been received;
0 points – no answer or the answer is incorrect.

***Maximum number of points** for the modular test:*
10 points × 2 theoretical questions + 20 points × 1 practical task = 40 points.

The rating scale for the discipline is equal to:
$R = RC = R_{lab.practice} + RMKR = 60 \text{ points} + 40 \text{ points} = 100 \text{ points}.$

Calendar control: carried out twice a semester as a monitoring of the current state of fulfillment of the requirements of the syllabus.
At the first calendar control (8th week), a student receives "passed" if his current rating is not less than 50% of the maximum number of points that a student can receive before the first calendar control.
At the second calendar control (14th week), a student receives "passed" if his current rating is not less than 50% of the maximum number of points that a student can receive before the second calendar control.

Semester control: credit.
Conditions for admission to semester control: with a semester rating (r_C) of at least 60 points and enrollment of all laboratory work, the student receives credit "automatically" in accordance with the table (Table of correspondence of rating points to grades on the university scale). Otherwise, he must complete a test work. A prerequisite for admission to the test is the performance and defense of laboratory work. If the student disagrees with the assessment, He can try to improve his grade by writing a test paper, while his points received for the semester are preserved, and out of the two grades received by the student, the best ("soft" grading system) is given.

Table of correspondence of rating points to grades on the university scale:

Score	*Score*
100-95	Perfectly
94-85	Very good
84-75	Well
74-65	Satisfactory
64-60	Enough
Less than 60	Disappointing
Admission conditions are not met	Not allowed

9. Additional information on the discipline (educational component)

Work program of the discipline (syllabus):

Approved by the Department of PZKS (Minutes No. 16 of 26.06.24)

Approved by the Methodological Commission of the Faculty of Applied Mathematics (Minutes No. 9 of 27.06.24)