National Technical University of Ukraine
"Igor Sikorsky Kyiv Polytechnic Institute"

Department of Computer Engineering

Methodologies and Technologies of Software Development

Working program of the academic discipline (Syllabus)

Requisites of the Course	
Level of higher education	***First (bachelor's)***
Field of Study	*12 Information technologies*
Specialty	*121 Software Engineering*
Education Program	*Computer Systems Software Engineering*
Type of Course	*Normative*
Mode of Studies	*Full-time*
Year of studies, semester	*2nd year, spring semester*
ECTS workload	*4 credits, 36 hours of lectures, 18 hours of laboratory hours, 66 hours of self-study*
Testing and assessment	*Final test*
Course Schedule	*http://roz.kpi.ua/*
Language of Instruction	*English*
Course Instructors	Lectures: Prof., Dr.Sc., Mykhailo Anatoliyovych Novotarsky, *novotar @ gmail . com* Laboratory: Assistant *Kovalchuk Oleksandr Myronovych , kovalchuk . oleksandr @ lll . kpi.ua*
Access to the course	*https://classroom.google.com/u/0/c/NTkyNTg0NDQ3NjI5*

Outline of the Course

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

The discipline "Methodologies and technologies of software development" is aimed at students' study of modern approaches and methods of software development. The discipline considers: software development tools and approaches, dependency management tools, logging and monitoring in modern software products, ways of organizing interaction during software development. The study of this discipline by future specialists will allow them to acquire important competencies in the field of software engineering.

The purpose of studying the discipline "Methodology and technology of software development" is to train specialists who are able to solve complex problems in the field of development of supported software and use modern approaches and tools during development.

The subject of the discipline is:

- theoretical and practical principles of development and support of software products;
- methods and means of interaction between developers during software development;
- software testing methods;
- methods of continuous integration;
- principles of software architecture construction;
- software delivery and deployment methods.

According to the requirements of the EP, after mastering the discipline "Methodologies and technologies of software development" students must demonstrate the competences of PC14, PC16, PC18 and program results of training PLO13, PLO15, PLO17, PLO22 , in particular:

- ability to abstract thinking, analysis and synthesis;
- ability to algorithmic and logical thinking;
- ability to develop and maintain software products;
- to know and be able to apply methods and technologies of developing software products.

According to the results of the study of the educational discipline "Methodology and technology of software development", the following **knowledge should be obtained** :

- conceptual and theoretical knowledge in the field of software engineering;
- methodological knowledge in terms of applying modern methods and technology for software development.

Skills that must be acquired within the framework of studying the educational discipline "Methodology and technology of software development":

- develop software;
- use software adaptation approaches to changes;
- apply modern software testing tools;
- effectively interact with the team during group software development;

This combination of acquired competences , theoretical and practical knowledge, abilities and skills contributes to the improvement of the professional level of bachelor's degree holders in order to carry out effective activities in the field of software product development.

2 Pre-requisites and post-requisites of the discipline (place in the structural and logical scheme of training according to the relevant educational program)

Necessary disciplines: "Algorithms and data structures", "Databases", "Programming Fundamentals" , " Software Engineering Components" - parts 1, 2 .

Mastering the discipline "Methodology and technology of software development" contributes to the assimilation of the following disciplines: " Software Engineering Components. Part 4", "Agile Programming Techniques" , "Risk and Quality Management of Projects" .

3 Content of the academic discipline

A list of the main topics included in the program of study of the discipline "Methodologies and technologies of software development":

Chapter 1. Introduction to the discipline
Topic 1.1. Purpose, subject and relevance of the discipline

Section 2. Version control systems
Topic 2.1. History of version control systems
Topic 2.2. Basic commands and tasks of the Git version control system
Topic 2.3. Team development using the Git version control system
Topic 2.4. The architecture and internal logic of the Git version control system

Chapter 3. Methodologies in software development
Topic 3.1. Writing unit tests, antipatterns when writing unit tests

Topic 3.2. Continuous integration in development on the example of GitHub Actions
Topic 3.3. Code review
Topic 3.4. Extreme programming practices
Topic 3.5. Clean architecture and clean code

Section 4. Preparation of the software product for deployment
Topic 4.1. Containerization as a method of delivering a software product (using docker as an example)
Topic 4.2. Security of software products and vulnerabilities
Topic 4.3. Logging and monitoring of the software product
Topic 4.4. Design of application programming interfaces (API)
Topic 4.5. Development and infrastructure in deployment

4 Educational materials and resources

1 *Software Engineering at Google by Titus Winters, Tom Manshreck, Hyrum Wright.*
URL: https://abseil.io/resources/swe-book
2 *Building Secure and Reliable Systems by Heather Adkins, Betsy Beyer, Paul Blankinship, Ana Oprea, Piotr Lewandowski, Adam Stubblefield.*
URL: https :// sre . google / static / pdf / building secure and reliable systems . pdf

Educational content

5 Methodology

Names of sections, topics	Number of hours			
	In total	Including		
		Lectures	Laboratory work	Self-study
Chapter 1. Introduction to the discipline Topic 1.1. Purpose, subject and relevance of the discipline	6	4		2
Section 2. Version control systems Topic 2.1. History of version control systems Topic 2.2. Basic commands and tasks of the Git version control system Topic 2.3. Team development using the Git version control system Topic 2.4. The architecture and internal logic of the Git version control system	30	8	4	18
Chapter 3. Methodologies in software development Topic 3.1. Writing unit tests, antipatterns when writing unit tests Topic 3.2. Continuous integration in development on the example of GitHub Actions Topic 3.3. Code review Topic 3.4. Extreme programming practices Topic 3.5. Clean architecture and clean code	40	12	6	22

Section 4. Preparation of the software product for deployment Topic 4.1. Containerization as a method of delivering a software product (using docker as an example) Topic 4.2. Security of software products and vulnerabilities Topic 4.3. Logging and monitoring of the software product Topic 4.4. Design of application programming interfaces (API) Topic 4.5. Development and infrastructure in deployment	44	12	8	24
Total in the semester	120	36	18	66

Laboratory classes:

The purpose of conducting laboratory classes is for students to consolidate theoretical knowledge and acquire the necessary practical skills for working with modern technologies for systems with artificial intelligence.

- Laboratory work #1: Working with the Git version control system ;
- Laboratory work #2: Writing unit tests;
- Laboratory work #3: Containerization using docker ;
- Laboratory work #4: Team work on the project;

6 Self-study

- preparation for lectures on the study of previous lecture material;
- preparation for laboratory work with the study of the theory of laboratory work with an oral answer to the given questions of the section;
- registration of the results of laboratory work in the form of a protocol.

Policy and control

7 Policy of academic discipline (educational component)

During classes in an academic discipline, students must adhere to certain disciplinary rules:

- extraneous conversations or other noise that interferes with classes are not allowed;
- the use of mobile phones and other technical means is not allowed without the teacher's permission.

Laboratory works are submitted in person with a preliminary check of theoretical knowledge, which is necessary for the performance of laboratory work. Validation of practical results includes code review and execution of test tasks.

8 Types of control and rating system for evaluating learning outcomes (RSO)

Current control: survey on the subject of the lesson

Calendar control: is conducted twice a semester as a monitoring of the current state of fulfillment of the syllabus requirements.

Semester control: assessment

Conditions for admission to semester control: enrollment of all laboratory works

Table 1 — Maximum points for individual laboratory works

Laboratory	Total by type of work
Laboratory work #1	15
Laboratory work #2	15
Laboratory work #3	25
Laboratory work #4	25
$R_{Л}$	80

The maximum score for the credit ($R_{З}$) is 20 points:

$$R_{З} = 20$$

The semester rating of a student in a discipline consists of grades for: laboratory work ($R_{Л}$) and credit ($R_{З}$).

$$R = R_{Л} + R_{З}$$

The student has the opportunity to receive a grade for credit automatically ($R_{а}$). For this, it is necessary to fulfill the conditions of admission to the semester control before the beginning of the assessment session . In this case, the grade for the discipline will be:

$$R = R_{а} = R_{Л} \cdot 1.25$$

If the work is submitted during the credit session , the student loses the right to automatic credit. In this case, the maximum score for the corresponding work will be 60% of that indicated in Table 1.

Table 2 — Correspondence of rating points to grades on the university scale

Rating	*Grades*
100-95	Excellent
94-85	Very good
84-75	Good
74-65	Satisfactorily
64-60	Sufficient
Less than 60	Fail
Admission conditions not met	Not allowed

9 Additional information on the discipline (educational component)

theoretical and practical questions, which are presented during the defense of laboratory works and semester control, correspond to the list of main topics included in the study program of the discipline "Methodologies and technologies of software development".

Working program of the academic discipline (syllabus):

Designed by an assistant at the Computer Engineering Department, Kovalchuk O. M.

Adopted by the Department of Computer Engineering (Protocol No. 10 dated 05/25/2022)

Approved by the methodical commission of the faculty (protocol No. 10 dated 09.06.2022)

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