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

Department of Biomedical Engineering

Technology of creating software products

Syllabus of the academic discipline (Syllabus)

Academic discipline requirements

Level of higher education	*First (bachelor's)*
Branch of knowledge	*16 Chemical and Bioengineering*
Specialty	*163 Biomedical Engineering*
Educational program	*Medical Engineering*
Discipline status	*Selective*
Form of study	*Full-time (daytime)/blended/distance learning*
Year of training, semester	*4th year, spring semester*
Scope of the discipline	*4 ECTS credit modules (120 hours)*
Semester control/control measures	*Final test, MTW, essay*
Class schedule	*Lectures (30 hours), practical classes (30 hours), ISW (60 hours)* *(According to the schedule on the website https://schedule.kpi.ua)*
Language of instruction	*Ukrainian / English*
Information about the course leader/teachers	*Lecturer: Candidate of Physical and Mathematical Sciences, Associate Professor, Solomin Andriy Vyacheslavovich, a.solomin@kpi.ua ; andr-sol@i.ua* *Practical: Candidate of Physical and Mathematical Sciences, Associate Professor, Solomin Andriy Vyacheslavovich, a.solomin@kpi.ua ; andr-sol@i.ua*
Teacher profile	*https://intellect.kpi.ua/profile/sav231* *http://bmi.fbmi.kpi.ua/department/staff-department/*
Course placement	*https://do.ipo.kpi.ua/course/view.php?id=2282*

Academic discipline program

1. Description of the academic discipline, its purpose, subject of study and results teaching

Purpose of discipline

The main goal of the academic discipline "Technology of creating software products" is to develop in students the ability to design, construct, test, configure, implement and maintain software systems, choosing optimal solutions based on modern technologies; develop software components; implement software architecture prototypes; freely navigate in current trends in the development of the industry; apply specialized knowledge in the field of informatics and computer technology to solve interdisciplinary engineering problems, as well as work effectively in solving innovative engineering problems.

The IT industry is currently developing the fastest in Ukraine (and in the world). The need for relevant specialists is growing every year. But to find your place, you need to know generally accepted technologies and tools, means of designing and developing software systems. The same applies to developments in biomedical engineering, since it is now difficult to imagine biomedical devices and systems without some kind of software. In addition, it is very useful to use these technologies and standards in diploma design.

Subject of the discipline

The academic discipline "Technology of creating software products" studies a complex of interrelated technologies based on a process approach to requirements engineering, design, construction, testing, and maintenance of complex software systems, according to appropriately selected life cycle models.

The discipline "Technology of creating software products" strengthens the following general competencies:

Integral competence (IC) - The ability to solve complex specialized tasks and practical problems in biomedical engineering or in the process of learning, which involves the application of certain theories and methods of chemical, biological and medical engineering, and is characterized by the complexity and uncertainty of conditions.

***GC 1** - Ability to apply knowledge in practical situations.*

***GC 2** - Knowledge and understanding of the subject area and understanding of professional activity.*

***GC 4** - Skills in using information and communication technologies.*

***GC 6** - Ability to search, process and analyze information from various sources.*

***GC 7** - Ability to generate new ideas (creativity).*

***GC 8** - Ability to make informed decisions.*

The discipline "Technology of creating software products" strengthens the following special (professional) competencies:

***PC 1** - Ability to use engineering software packages to conduct research, analyze, process and present results, as well as for automated design of medical devices and systems.*

***PC 3** - Ability to learn and apply new methods and tools for analysis, modeling, design, and optimization of medical devices and systems.*

***PC 10** - Ability to apply the principles of building modern automated production management systems for medical devices, their technical, algorithmic, information and software support.*

***Ability** to design, construct, test, configure, implement and maintain software systems, choosing optimal solutions based on modern technologies; develop software components; implement software architecture prototypes; freely navigate modern industry development trends.*

The discipline "Software Development Technology" strengthens the abilities in the following program learning outcomes:

***PLO 5** - Be able to use databases, mathematical and software for data processing and computer modeling of biotechnical systems.*

***PLO 13** - Be able to analyze signals transmitted from organs to devices and process diagnostic information (signals and images).*

***PLO 14** - Be able to analyze the level of compliance with modern world standards, as well as evaluate solutions and formulate tasks for the development of automated control systems, taking into account the capabilities of modern technical and software tools for automating medical equipment.*

***PLO 20 -** Knowledge and use of methods for researching biomedical engineering objects, methods and means of systematizing and processing experimental information, methods of statistical processing for modeling and simulation of processes and systems of physical and biological nature, modern programming*

technologies and tools that support their use, methods for designing digital and microprocessor systems for medical purposes.

***Knowledge** of the basics of algorithmization, modern methodologies for software development, modern programming languages, the concept of the software product life cycle, relevant basic international standards, their application and classification. Theoretical knowledge and practical skills in the field of application of software tools.*

2. Prerequisites and postrequisites of the discipline (place in the structural and logical scheme of study according to the relevant educational program)

According to the structural and logical scheme of the specialist training program, the discipline "Technology of creating software products" is included in the list of elective disciplines aimed at the formation (strengthening) of general and professional competencies.

Prerequisites – the academic discipline is taught in the 8th semester of the 4th year of study and does not directly depend on other academic disciplines in the structural and logical scheme of the educational program. The basis for studying the academic discipline is basic knowledge of the disciplines of the computer science block: "Basics of Informatics", "Object-oriented Programming".

Post-requisites - this academic discipline has no interdisciplinary connections. The practical skills and theoretical knowledge acquired while studying the academic discipline "Technology of creating software products" can be used in the future during pre-graduate practice, for the preparation of diploma theses in the specialty and in further practical work in the specialty.

3. Course content disciplines

The main sections and topics that will be covered during the course:

1. Introduction. Historical and social context of software engineering. Disciplines and content of software engineering. General principles of software product development.

- *Historical aspects of software development and software product creation technology.*
- *Disciplines and problems of software engineering. General principles of software development*
- *systems.*

2. SWEBOK Core Knowledge. Characteristics of Areas software engineering knowledge.

- *Core knowledge SWEBOK – generalization experience and basis standards in industries software engineering.*
- *SWEBOK structure.*
- *Characteristics of software engineering knowledge areas.*

3. Software development life cycle (SDL) processes. Waterfall (cascade, classic) development life cycle model Software.

- *The concept of software life cycle. Life cycle processes.*
- *Life cycle models.*
- *Basic concepts and processes of the waterfall model of the Lifecycle Management System.*
- *Features of the waterfall model. Examples of applications.*
- *Advantages and disadvantages.*

4. Incremental and evolutionary software development life cycle models.

- *Basic concepts and processes of the incremental life cycle model.*
- *Features of the incremental model. Examples of applications.*
- *Basic concepts and processes of the evolutionary life cycle model.*
- *Features of the evolutionary model. Examples of applications.*
- *Advantages and disadvantages.*

5. Spiral model of software development life cycle. Agile model of software development life cycle.

- *Basic concepts and processes of the spiral model of the Lifecycle Management.*
- *Features of the spiral model. Examples of applications.*
- *Basic concepts and processes of the Agile model of the Lifecycle Management.*
- *Features of the Agile model. Examples of applications.*
- *Advantages and disadvantages.*

6. International and national standards for the development of complex software products.
- *Corporate, industry, government and international standards.*
- *SWEBOK Core Knowledge, PMBOK and Software Lifecycle Standards.*
- *Basic software engineering standards. ISO/IEC 12207, ISO/IEC 15504, SEI CMM standards.*

7. Foundations designing software systems. Modularity, informational closedness, connectivity.
- *Analysis and synthesis in software systems design.*
- *System structuring.*
- *Control modeling.*
- *Decomposition of subsystems into modules.*
- *Modularity.*
- *Informational closure.*
- *Connectivity and types of connectivity*

8. Module cohesion, complexity and quality of the hierarchical structure of software systems.
- *Cohesion of modules.*
- *Software system complexity metrics.*
- *Characteristics of the hierarchical structure of software systems.*

9. Software development methodologies (RUP, MSF, XP, DSDM, RAD).
- *Engineering of industrial production of software products.*
- *Environments for automated production of software products.*
- *Features methodologies developments Software: RUP, MSF, XP, DSDM, RAD.*

10. Software architecture, standards for describing software architectures. Software design patterns.
- *The concept of software architecture.*
- *Software architecture design as one of the stages of the life cycle.*
- *Standardized, object-oriented, component-based architecture design methods.*
- *Standards for describing software architectures.*
- *Component-based programming.*
- *Types of component structures.*
- *Template (pattern) as an extension of the concept of "component".*
- *Methodology of component software development.*

11. Software product development automation tools. Software quality, quality metrics, software quality standards.
- *Automated designing informational systems with using CASE technologies.*
- *Classification of CASE technologies.*
- *Technology support tools and their classes.*
- *Principles of organizing design using CASE tools.*
- *Analysis of the functional capabilities of CASE tools of different classes.*
- *Software systems quality model.*
- *Standard quality indicators.*
- *External and internal quality metrics.*
- *Software quality management systems.*

12. Analysis customer requirements to Software.
- *Requirements classification.*
- *Requirements analysis and collection.*
- *Requirements engineering.*
- *Requirements capture.*
- *Requirements tracking.*

- *Development of technical specifications.*

13. Verification, validation and testing. Software testing standards. Software product support. Operational, advertising software documentation.

- *Software testing as one of the stages of the life cycle.*
- *Principles of verification, validation and testing of software systems.*
- *Processes and tools for testing software components.*
- *Functional testing.*
- *Classification of errors and methods for finding them.*
- *Organization and methods of software maintenance.*
- *Organization of software documentation.*
- *Requirements for documentation of complex software tools.*
- *Documenting software product certification processes and results.*

Computer workshop

The main objectives of the cycle of computer workshops: developing skills in the optimal and effective application of modern information technologies to solve computerization problems in biomedical engineering, as well as familiarization and mastery of skills in working with relevant computer application packages.

Topics of practical work:

1. *NI Software Environment LabVIEW.*
2. *Editing and configuring virtual devices.*
3. *Hierarchical structure virtual devices. Virtual appliances and sub-devices.*
4. *Managing program execution using structures. Cycles.*
5. *Managing program execution using structures. Case structures.*
6. *Arrays.*
7. *Clusters.*
8. *Waveform graphs (WAVEFORM CHART).*
9. *Graphs (WAVEFORM GRAPH, XY GRAPH).*
10. *Intensity graphs.*
11. *String data.*
12. *Writing and reading files.*

4. Educational materials and resource

Basic literature

1. *Технології розробки програмного забезпечення. Курс лекцій [Електронний ресурс] : навч. посіб. для здобувачів ступеня бакалавра за освіт. програмою «Цифрові технології в енергетиці» спец. 122 Комп'ютерні науки / КПІ ім. Ігоря Сікорського; уклад.: В. О. Тихоход, А. Л. Гурін, О. М. Беспала. — Електрон. текст. дані (1 файл). — Київ: КПІ ім. Ігоря Сікорського, 2024. — 230 с. – Режим доступу: https://ela.kpi.ua/server/api/core/bitstreams/03af262e-0783-40c6-82d5-0608b22193ba/content*
2. *Цибульник С.О., Барандич К.С. Технології розроблення програмного забезпечення. Частина 1. Життєвий цикл програмного забезпечення. - Київ: КПІ ім. Ігоря Сікорського, 2022. - 270 с. – Режим доступу: https://ela.kpi.ua/server/api/core/bitstreams/9521e5f9-421a-4874-a17d-f0853f942856/content*
3. *Навчальний посібник з дисципліни «Технології розробки програмного забезпечення» для студентів спеціальності 123 «Комп'ютерна інженерія»/укл. Дегтярьова Л.М., Гроза П.М., Сомов С.В. – Полтава: ПолтНТУ, 2017. – 218 с. – Режим доступу: http://reposit.nupp.edu.ua/bitstream/PoltNTU/4431/1/%D0%A3%D1%87%D0%B5%D0%B1%D0%BD%D0%B8%D0%BA_%D0%A2%D0%A0%D0%9F%D0%97_%D0%BF%D1%80%D0*

%BE%D0%B2%D0%B5%D1%80%D0%B5%D0%BD%D0%BE-converted.pdf
4. *Якість програмного забезпечення та тестування: базовий курс. Навчальний посібник / За ред. Крепич С.Я., Співак І.Я. / для бакалаврів галузі знань 12 «Інформаційні технології» спеціальності 121 «Інженерія програмного забезпечення». – Тернопіль: ФОП Паляниця В.А., 2020. – 478с. – Режим доступу: http://dspace.wunu.edu.ua/bitstream/316497/39773/1/%D0%9D%D0%B0%D0%B2%D1%87%D0%B0%D0%BB%D1%8C%D0%BD%D0%B8%D0%B9%20%D0%BF%D0%BE%D1%81%D1%96%D0%B1%D0%BD%D0%B8%D0%BA%20%D0%B7%20%D1%8F%D0%BA%D0%BE%D1%81%D1%82%D1%96%20%D0%9F%D0%97%20%D1%82%D0%B0%20%D1%82%D0%B5%D1%81%D1%82%D1%83%D0%B2%D0%B0%D0%BD%D0%BD%D1%8F%20%281%29.pdf*
5. *Карпенко М. Ю. Технології створення програмних продуктів та інформаційних систем : навч. посібник / М. Ю. Карпенко, Н. О. Манакова, І. О. Гавриленко ; Харків. нац. ун-т міськ. госп-ва ім. О. М. Бекетова. – Харків : ХНУМГ ім. О. М. Бекетова, 2017. – 93 с. – Режим доступу: http://eprints.kname.edu.ua/46989/1/2017%20%D0%BF%D0%B5%D1%87.%2024%D0%9D%20%D0%9F%D0%BE%D1%81%D0%BE%D0%B1%D0%B8%D0%B514.04.17 .pdf*
6. *Авраменко А.С., Авраменко В.С., Косенюк Г.В. Тестування програмного забезпечення. Навчальний посібник. – Черкаси: ЧНУ імені Богдана Хмельницького, 2017. – 284 с. – Режим доступу: http://eprints.cdu.edu.ua/1482/1/testyvan.pdf*
7. *Програмування в NI LabVIEW. Технологія розробки віртуальних приладів : навч. посіб. / О.Г. Кисельова, А.В. Соломін. – К. : НТУУ «КПІ», 2013. – 273 с. – Надсилається викладачем на електронну пошту групи.*
8. *Лавріщева К.М. Програмна інженерія : Підручник.-К.- 2008.-319 с. – Режим доступу: www.cyb.univ.kiev.ua/library/books/lavrishcheva-6.pdf*
9. *Технологія створення програмних продуктів. Програмування в NI LabVIEW : навч. посіб. / О.Г. Кисельова, А.В. Соломін. – К.: НТУУ «КПІ», 2012. – 200 с. – Надсилається викладачем на електронну пошту групи.Additional literature.*

Additional literature

1. *Software engineering / S. Bhosale, V. Pujari, A. Patil. – Laxmi Book Publication, 2018. – 167p.*
2. *Software engineering / R. Prasad, G. Verma. – New Delhi, 2016. – 364p.*
3. *An Integrated Approach to Software engineering / P. Jalote. - Springer. –571p.*
4. *Software engineering / M.Sharma. – Biyani College Printing Department. – 94p.*
5. *LabVIEW for Everyone: Graphical Programming Made Easy and Fun, Third Edition / Jeffrey Travis, Jim Kring. - Prentice Hall, 2006. - 1032p.*

Information resources

1. *https://do.ipo.kpi.ua/course/view.php?id=2282 - Platform remote "Sikorsky" training*

2. *http://www.ni.com/labview/ - National Instruments website*

3. *www.picad.com.ua/lesson.htm - educational materials on LabVIEW*

The list of information resources includes their sources.

Educational content

5. Methodology for mastering an academic discipline (educational component)

To study the discipline, 15 lecture sessions and 12 practical sessions (PL) are planned, during which, among other things, a modular test is planned.
Students are trained using copies of educational literature from the technical library of NTUU "Igor Sikorsky Kyiv Polytechnic Institute" and the faculty, course teaching materials based on the "Sikorsky" Distance Learning Platform, and additional textbooks provided to them in electronic form, namely:
Kyseleva O.G., Solomin A.V. Textbook. Technology of creating software products. Programming in LabVIEW. - Kyiv, 2012.

Kyseleva O.G., Solomin A.V. Textbook. Technology of development of virtual devices. Programming in LabVIEW. - Kyiv, 2014.
When studying the educational material, the following teaching methods are used: lecture classes are held using the explanatory-illustrative method, the problem-based presentation method.
The study of theoretical material of lectures is accompanied by consideration of examples using the capabilities of the NI LabVIEW package and others in preparation for practical work. Practical works are held using:
1) A reproductive method, thanks to which students consolidate the studied theoretical material and learn to use it in specific tasks.
2) Partial search, or heuristic method, which teaches how to find the right paths and methods of solving problems tasks.
Verification of the mastery of the material is carried out during practical classes, using computer testing.
The methodological model of teaching the discipline is based on the use of active learning methods. The organization of the educational process is based on the following principles:
- choosing teaching methods depending on various factors that influence the organization of the educational process, on the contingent students;
- combining several methods into a single teaching module to increase the efficiency of the process teaching;
- active participation of students in the learning process;
- conducting practical classes that contribute to the acquisition of skills and experience in solving problems;
- providing examples of using theoretical material in real practical situations;
- emphasizing the specifics of the subject in relation to medical and biological aspects of use, interest in new achievements and technologies;
- flexible and differentiated approach to each student, taking into account the degree of previous training;
- forecasting future development directions.
During training and for interaction with students, modern information, communication and network technologies are used, and an appropriate online course on the "Sikorsky" platform has been developed and is constantly being improved.

Topic names	***Lectures***		***Practical classes***		***ISW***	***Assessment of practical classes (PC)***
	Weekly teaching	*Hours*	*Weekly teaching*	*Hours*	*Hours*	
Topic 1. Introduction. Historical and social context of software engineering. Disciplines and content of software engineering. General principles of software product development. Topic 2. SWEBOK Core Knowledge. Characteristics of Areas software engineering knowledge	*1*	*3*	*1-2*	*4*	*5*	*PC 1.2*
Topic 3. Software development life cycle (SDL) processes. Waterfall (cascade, classic) development life cycle model Software	*2*	*3*	*2-3*	*4*	*5*	*PC 3, 4*
Topic 4. Incremental and evolutionary software	*3*	*3*	*3-4*	*4*	*5*	*PC 5.6*

development life cycle models						
Topic 5. Spiral model of software development life cycle. Agile model of software development life cycle	*4*	*3*	*5*	*2*	*3*	*PC 7*
Topic 6. International and national standards for the development of complex software products	*5*	*3*	*5-6*	*4*	*5*	*PC 8, 9*
Topic 7. Fundamentals of software systems design. Modularity, informational closedness, connectivity	*6*	*3*	*7*	*3*	*3*	*PC 10*
Topic 8. Module cohesion, complexity and quality of the hierarchical structure of software systems	*7*	*3*	*8*	*3*	*3*	*PC 11*
Topic 9 Software development methodologies (RUP, MSF, XP, DSDM, RAD)	*8*	*3*	*9*	*2*	*3*	*PC 12*
Topic 10. Software architecture, standards for describing software architectures. Software design patterns. *Topic 11. Software product development automation tools. Software quality, quality metrics, software quality standards*	*9*	*3*	*9-10*	*2*	*3*	*PC 13*
Topic 12. Analysis customer requirements to Software. *Topic 13. Verification, validation and testing. Software testing standards. Software product support. Operational, advertising software documentation*	*10*	*3*			*2*	
Modular test work			*10*	*2*	*2*	*MTW*
Essay			*9-10*		*15*	*Essay*
Final test			*11*	*(2)*	*6*	*Final test*
Total hours		***30***		***30***	***60***	

Recommendations for mastering the training sessions (in the form of a detailed description of each session and planned work):

5.1. Lectures

List of didactic aids for lectures: Lecture notes, projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning, the Zoom platform.

No.	Title of the lecture topic and list of main questions (list of didactic aids, tasks for the SRS with references to literature)	Number of hours
1	***Introduction. Historical and social context of software engineering. Disciplines and content of software engineering. General principles of software product development.*** *Historical aspects of software development and technology of software product creation. Disciplines and problems of software engineering. General principles of software system development.* ***List of teaching aids:*** *Lecture notes; projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning - the Zoom platform.* ***Tasks for the ISW:*** *Review the lecture material, prepare for practical classes on these sections, study literary sources [3, Section 2; 7; Moodle: https://do.ipo.kpi.ua/pluginfile.php/475800/mod_resource/content/1/%D0%9B%D0%B5%D0%BA%D1%86%D1%96%D1%8F%201.pdf]*	**1.5**
2	***SWEBOK Core Knowledge. Characteristics of Areas software engineering knowledge.*** *SWEBOK Core Knowledge is a generalization of experience and a basis for standards in the field of software engineering. SWEBOK Structure. Characteristics of knowledge areas in software engineering.* ***List of teaching aids:*** *Lecture notes; projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning - the Zoom platform.* ***Tasks for the ISW:*** *Review the lecture material, prepare for practical classes on these sections, and study literary sources [Moodle: https://do.ipo.kpi.ua/pluginfile.php/480102/mod_resource/content/1/%D0%9B%D0%B5%D0%BA%D1%86%D1%96%D1%8F%202.pdf]*	**1.5**
3	***Software development life cycle (SDL) processes. Waterfall (cascade, classic) development life cycle model Software.*** *Concept of software life cycle. Life cycle processes. Life cycle models. Basic concepts and processes of the waterfall model of the SDL. Features of the waterfall model. Examples of applications. Advantages and disadvantages.* ***List of teaching aids:*** *Lecture notes; projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning - the Zoom platform.* ***Tasks for the ISW:*** *Review the lecture material, prepare for practical classes on these sections, and study literary sources [1, Lecture 1; Moodle: https://do.ipo.kpi.ua/pluginfile.php/485906/mod_resource/content/1/%D0%9B%D0%B5%D0%BA%D1%86%D1%96%D1%8F%204-6.pdf]*	**3**
4	***Incremental and evolutionary software development life cycle models.*** *Basic concepts and processes of the incremental life cycle model. Features of the incremental model. Examples of applications. Basic concepts and processes of the evolutionary life cycle model. Features of the evolutionary model. Examples of applications. Advantages and disadvantages.* ***List of teaching aids:*** *Lecture notes; projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning - the Zoom platform.* ***Tasks for the ISW:*** *1. Review the lecture material, prepare for practical classes on these sections, study of literary sources [1, Lecture 1; Moodle: https://do.ipo.kpi.ua/pluginfile.php/485906/mod_resource/content/1/%D0%9B%D0%B5%D0%BA%D1%86%D1%96%D1%8F%204-6.pdf]*	**3**
5	***Spiral model of software development life cycle. Agile model of software development life cycle.*** *Basic concepts and processes of the spiral model of life cycle. Features of the*	**1.5**

	spiral model. Examples of applications. Basic concepts and processes of the Agile model of life cycle. Features of the Agile model. Examples of applications. Advantages and disadvantages. ***List of teaching aids:*** *Lecture notes; projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning - the Zoom platform.* ***Tasks for the ISW:*** *1. Review the lecture material, prepare for practical classes on these sections, study literary sources [1, Lectures 1,2,3; Moodle: https://do.ipo.kpi.ua/pluginfile.php/485906/mod_resource/content/1/%D0%9B%D0%B5%D0%BA%D1%86%D1%96%D1%8F%204-6.pdf]*	
6	***International and national standards for the development of complex software products.*** *Corporate, industry, state and international standards. SWEBOK, PMBOK Core Knowledge and Software Lifecycle Standards. Basic software engineering standards. ISO/IEC 12207, ISO/IEC 15504, SEI CMM standards.* ***List of teaching aids:*** *Lecture notes; projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning - the Zoom platform.* ***Tasks for the ISW:*** *1. Review the lecture material, prepare for practical classes on these sections, study literary sources [Moodle: https://do.ipo.kpi.ua/pluginfile.php/475800/mod_resource/content/1/%D0%9B%D0%B5%D0%BA%D1%86%D1%96%D1%8F%201.pdf]*	***1.5***
7	***Fundamentals of software systems design. Modularity, informational closedness, connectivity.*** *Analysis and synthesis in software systems design. System structuring. Control modeling. Decomposition of subsystems into modules. Modularity. Informational closure. Connectivity and types of connectivity* ***List of teaching aids:*** *Lecture notes; projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning - the Zoom platform.* ***Tasks for the ISW:*** *1. Review the lecture material, prepare for practical classes on these sections, study of literary sources [1, Lectures 7,8,9; 2, Section 3; Moodle: https://do.ipo.kpi.ua/pluginfile.php/488613/mod_resource/content/1/%D0%9B%D0%B5%D0%BA%D1%86%D1%96%D1%8F%207-12.pdf]*	***3***
8	***Module cohesion, complexity and quality of the hierarchical structure of software systems.*** *Module cohesion. Metrics of complexity of software systems. Characteristics of the hierarchical structure of software systems.* ***List of teaching aids:*** *Lecture notes; projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning - the Zoom platform.* ***Tasks for the ISW:*** *1. Review the lecture material, prepare for practical classes on these sections, study of literary sources [3, Section 4; Moodle: https://do.ipo.kpi.ua/pluginfile.php/488613/mod_resource/content/1/%D0%9B%D0%B5%D0%BA%D1%86%D1%96%D1%8F%207-12.pdf]]*	***3***
9	***Software development methodologies (RUP, MSF, XP, DSDM, RAD).*** *Engineering of industrial production of software products. Environments for automated production of software products. Features of software development methodologies: RUP, MSF, XP, DSDM, RAD.* ***List of teaching aids:*** *Lecture notes; projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning - the Zoom platform.* ***Tasks for the ISW:*** *Review the lecture material, prepare for practical classes on these sections, and study*	***3***

	literary sources [Moodle: https://do.ipo.kpi.ua/pluginfile.php/485906/mod_resource/content/1/%D0%9B%D0%B5%D0%BA%D1%86%D1%96%D1%8F%204-6.pdf]	
10	***Software architecture, standards for describing software architectures. Software design patterns.*** *The concept of software architecture. Software architecture design as one of the stages of the life cycle. Standardized, object-oriented, component-based methods of architecture design. Standards for describing software architectures. Component programming. Types of component structures. Template (pattern) as an extension of the concept of "component". Methodology of component software development.* ***Tasks for the ISW:*** *1. Review the lecture material, prepare for practical classes on these sections, study of literary sources [1, Lecture 11; 2, Section 3]*	***1.5***
11	***Software product development automation tools. Software quality, quality metrics, software quality standards.*** *Automated design of information systems using CASE technologies. Classification of CASE technologies. Technology support tools and their classes. Principles of design organization using CASE tools. Analysis of the functionality of CASE tools of different classes. Software system quality model. Standard quality indicators. External and internal quality metrics. Software system quality management* ***List of teaching aids:*** *Lecture notes; projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning - the Zoom platform.* ***Tasks for the ISW:*** *1. Review the lecture material, prepare for practical classes on these sections, study of literary sources [1, Lecture 6 ; 3, Section 4; Moodle: https://do.ipo.kpi.ua/pluginfile.php/475800/mod_resource/content/1/%D0%9B%D0%B5%D0%BA%D1%86%D1%96%D1%8F%201.pdf]*	***1.5***
12	***Analysis customer requirements for software.*** *Classification of requirements. Analysis and collection of requirements. Requirements engineering. Requirements capture. Requirements tracing. Development of technical specifications.* ***List of teaching aids:*** *Lecture notes; projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning - the Zoom platform.* ***Tasks for the ISW:*** *1. Review the lecture material, prepare for practical classes on these sections, study of literary sources [1, Lectures 4,5]*	***3***
13	***Verification, validation and testing. Software testing standards. Software product support. Operational, advertising software documentation.*** *Software testing as one of the stages of the life cycle. Principles of verification, validation, and testing of software systems. Processes and means of testing software components. Functional testing. Classification of errors and methods for finding them. Organization and methods of software support. Organization of software documentation. Requirements for documentation of complex software. Documentation of processes and results of software product certification.* ***List of teaching aids:*** *Lecture notes; projection multimedia equipment; Power presentation Point, methodological materials on the Sikorsky platform (Moodle); for distance learning - the Zoom platform.* ***Tasks for the ISW:*** *1. Review the lecture material, prepare for practical classes on these sections, study of literary sources [1, Lectures 16,17; 3, 3.6-3.9]*	***3***
Total		***30***

5.2. Practical work

Topics of practical work:

1. *NI Software Environment LabVIEW.*
2. *Editing and configuring virtual devices.*

3. *Hierarchical structure virtual devices. Virtual appliances and sub-devices.*
4. *Managing program execution using structures. Cycles.*
5. *Managing program execution using structures. Case structures.*
6. *Arrays.*
7. *Clusters.*
8. *Waveform graphs (WAVEFORM CHART).*
9. *Graphs (WAVEFORM GRAPH, XY GRAPH).*
10. *Intensity graphs.*
11. *String data.*
12. *Writing and reading files.*

Distance learning platform:

For more effective communication in order to understand the structure of the academic discipline "Technology of creating software products" and master the material, e-mail, Telegram channel, the distance learning platform "Sikorsky" based on the Moodle system of KPI-Telecom, and the Zoom online meeting service are used, with the help of which:
- the efficiency of communication with students increases, convenient feedback is provided;
- simplifies the placement, access and exchange of educational material;
- learning tasks of students are assessed;
- activity students being analyzed.

6. Independent work student

The following types of independent work are planned: preparation for lectures and practical classes; performance, processing of practical work results, preparation of a report; preparation for a modular control work; performance of an essay. A total of 60 hours are planned for independent work.
6.1. Topics for independent study – no planned
6.2. Preparation for lectures and practical classes. To prepare for lectures and practical classes, the student must study the planned basic and auxiliary literature, recommended sources, and prepare material for discussion in class. The student is allocated 37 hours for this ISW.
6.3. Modular control work. On preparation to MTW the 2 hours ISW is given.
6.4. Completion of an individual assignment - an essay. 15 hours of ISW are allocated for the preparation and design of the essay. The student must choose and approve the topic of the essay from the teacher no later than 4 weeks from the beginning of the academic semester. The deadline for submitting the essay to the teacher is no later than 8th week. The defense of the essay is planned at an unscheduled session from 9 to 10 weeks.
An essay is a scientific and technical document that contains comprehensive, systematized information on a selected topic, provides for a presentation of the material based on specially selected literature and independently conducted research. A student may write an essay only on a topic agreed upon with the teacher. General requirements for essay:
• definition and logical sequence exposition material;
• persuasiveness arguments;
• brevity and precision of wording, which excludes the possibility of ambiguity interpretation;
• concreteness of presentation of results research;
• the validity of recommendations and proposals.
The essay should include reflected:
• topicality topics and conformity to modern state science, techniques and production issues;
• justification of the chosen research direction, methods for solving the problem and their comparative evaluation;
• analysis and generalization of existing results;
• development of a general methodology for conducting research;
• nature and content completed theoretical research and calculations, methods research;
• justification of the need for experimental research, the principle of operation of the developed programs, the characteristics of these programs, assessment of calculation errors, obtained experimental results data;
• assessment of the completeness of the solution to the given problem tasks;

• assessment of the reliability of the results obtained, their comparison with similar ones results;
• scientific and practical value of the work performed work.
Essay structure: title page; table of contents; list of symbols, abbreviations, units and terms (if necessary); introduction; essence of the essay (main part); conclusions; list of sources used (reference list); appendices (if necessary).
Approximate topic of the essay:
1. Development of a model of a hardware-software complex for monitoring cardiac rhythm.
2. Development means express diagnostics in environment NI LabVIEW.
3. Development of a virtual tool for generating test sound signals for hearing diagnostics human.
4. Development of a wavelet signal analysis system hearts.
5. Development of an automated doctor's workplace, electronic filing system patients.
6. Development of a virtual device for diagnosing color blindness human.
7. Virtual device for processing and improving the quality of X-rays images.
8. 3D reconstruction of biomedical objects based on computer data tomography.
9. Virtual device for preprocessing microscopic images in biomedicine.
10. Virtual devices for statistical information processing in biomedicine.
11. Development of a system for measuring and analyzing arterial pressure.
12. Development of a system for measuring and analyzing pulmonary pressure.
13. Virtual development electrocardiograph.
14. Development of a virtual device for measuring the speed of propagation of pulse waves waves.
15. Development of an indoor temperature monitoring system organs.
16. Development of a virtual noise measurement device hearts.
17. Development of a system for predicting the blood type, Rh factor and gender of a child based on indicators parents.
18. Development of virtual equipment for assessing the state of the cardiovascular system human.
19. Development of a system for cardiointervalogram research human.
20. Development of a virtual device for determining human reaction speed.
21. Development of a virtual device for diagnosing a person's mental state (for example, based on associations that arise when considering pictures).
22. Virtual instrument for analysis electrocardiogram.
23. Virtual device for quality improvement electrocardiogram.
24. Virtual device for semi-automated processing echocardiogram.
25. Virtual device for semi-automated processing and analysis electroencephalogram.
26. Virtual instrument for measurement and monitoring noise in indoors.

The title page of the essay should have the following content: name of the university; name of the faculty; name of the department; name of the specialty, name of the educational and professional program, name of the academic discipline; topic of the essay; surname and name of the student, course, academic group number, year. The title page is followed by a detailed plan (contents) of the essay, which should include the introduction, sections of the main content (main topics that will be considered), their subdivisions (if necessary), conclusion, list of sources used. The table of contents indicates the page numbers of the beginning of each question on the right. Each section begins with a new page. The total volume of the essay is approximately 20 pages of the main text. The volume of the essay is determined by the student's ability to briefly and at the same time comprehensively explain and analyze the selected topic.
Mandatory requirement: clear reference to sources of information. All figures, facts, opinions of scientists, quotes, formulas must have references in the form [2, p. 54] (the first digit means the source number in given in ends creative works list literature, and friend figure – page number in this source). It is advisable to use tables, diagrams, graphs, charts, etc. The list of sources used (at least 10 sources) is drawn up in accordance with the current rules. If the information is taken from the Internet, it is necessary, as for a regular literature, indicate the author, the title of the article, and then provide the address of the website on the Internet. The essay is evaluated according to the following criteria: logicality of the plan; completeness and depth of disclosure of the topic; reliability of the data obtained; reflection of practical materials; correct formulation of the obtained results and conclusions; design; substantiation of the student's own opinion on this issue in the form of conclusion.
The essay is not checked for plagiarism, but must meet the requirements of academic integrity. If

academic dishonesty is detected, the work is canceled and not checked.
6.5. Credit. Credit is given at the credit session after students complete the module control work and defend an individual assignment - an essay and reports on practical classes. Based on the results of the rating points earned for the semester, the applicant receives credit without additional tests, if sum recruited points not smaller 60. Applicants, which have met all the admission conditions for the test and have rating points from 41 to 59, or wish to improve their result - take a test or undergo an interview on test questions. 6 hours of ISW are allocated for preparation for the test. During the distance learning period, the test can be conducted according to the class schedule using the Sikorsky platform and the platform for conducting online meetings Zoom.

No.	Types of independent work	Number hours
1	Preparation for lectures and practical classes	10
2	Completion of tasks on the topic of practical classes	27
3	Preparation for the modular test	2
4	Writing an essay	15
5	Final test	6
Together		**60**

Politics and control

7. Academic discipline policy (educational component)

7.1. Incentive points

Incentive points	
Criterion	Weighted score
The use of new technologies not provided for in the curriculum, when completing an essay and practical work	+1
Taking additional distance learning courses on topics agreed upon with teachers	+5
Preparation of scientific work for participation in the competition student research papers	+10
Writing theses, articles, participation in international, all-Ukrainian and/or other events or competitions on the topic of the academic discipline	+5

However, according to the provisions of https://osvita.kpi.ua/node/37, clause 2.7, the amount of incentive points cannot exceed 10% of the rating scale.

7.2. Visiting rules classes

Attending lectures and practical classes is not mandatory, but desirable, since it is through mastering the lecture material that systemic competencies are formed, which are then consolidated in practical classes.

The assessment system is focused on obtaining points, including for student activity, as well as completing tasks that can develop practical skills and abilities.

Missed practical classes can be completed and defended during the week.

7.3. Rules for performing individual task

The main goal of completing an individual assignment (essay) is to solve a practical problem using theoretical material learned in lectures and independently, and practical skills obtained in PC. A

student can write an essay only on the date agreed with the teacher. topic.

The essay is evaluated according to the following criteria: relevance of the topic, completeness of coverage of the material, quality of the essay structure, compliance with accepted standards for scientific and technical materials, quality of the essay design.

Deadline for submitting an essay for review: 8th week of study. The essay defense is held in weeks 9-10.

The essay is not checked for plagiarism, but must meet the requirements of academic integrity. If academic dishonesty is detected, the work is canceled and not checked.

7.4. Deadline policy and rearrangements

Missed control measures (defense of practical work) must be completed in subsequent classes, provided that the task scheduled for the current class or consultations is completed.

A missed control measure (MTW) can be completed at an additional (consultation) session, but only in case of a missed test for good reasons.

An essay submitted for review after the deadline is evaluated with a reduced number of weighted points.

7.5. Procedure for appealing test results events

Students have the opportunity to raise any issue related to the monitoring procedure and expect it to be addressed in accordance with the defined procedures.

The student has the right to appeal the results of the control measure in accordance with the approved regulations About appeals in KPI name Igor Sikorsky (approved by order No. HOH/128/2021 dated 05/20/2021) https://osvita.kpi.ua/index.php/node/182

7.6. Remote teaching

Distance learning takes place through the Sikorsky Distance Learning Platform.

Distance learning through taking additional online courses on a specific topic allowed by conditions coordination from students. In case, if small number of students wish to take an online course on a specific topic, studying the material through such courses is allowed, but students must complete all the tasks provided in the curriculum discipline.

The list of courses is offered by the teacher after students express their desire (since the bank of available courses is updated almost every monthly).

The student provides a document confirming completion of the distance learning course (in case of completing the full course) or provides completed practical tasks from the distance learning course and, subject to passing an oral interview with the teacher on the topics covered, may receive grades. by control measures, which provided by studied topics.

Practical work, as well as individual assignments, are carried out during independent work of students in remote mode (with the possibility of consulting with the teacher via email and social networks).

7.7. Studying in a foreign language in the language

Teaching in English is provided only for foreign students.

At the request of students, it is allowed to study the material using English-language online courses on topics that correspond to the topics of specific classes.

7.8. University policy

Academic virtue

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". More information: 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". More information: https://kpi.ua/code.

7.9. Inclusive teaching

The academic discipline "Technology of creating software products" can be taught to most students with special educational needs, except for students with severe visual impairments that prevent them from completing tasks using personal computers, laptops, and/or other technical means.

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

Current control: *carried out during training sessions and aims to check the level of training students to educational classes and current implementation educational programs. During practical classes, reports on practical works are completed and defended. There is also provision for modular control work and individual work (essay).*

Calendar control: *not carried out for 4th year students.*

Evaluation and control measures Control

measures evaluation system:

No	Control measure	%	Weighted score	Number	Total
1.	Practical work	60	5	12	60
2.	Essay	20	20	1	20
3.	Modular test work	20	20	1	20
	Total				100

Results are announced to each student separately in presence or in remote form (on the Sikorsky platform, e-campus or by e-mail)

8.1. Execution and defense of reports from practical classes

12 reports are planned from practical works.
Report weighting – 5 points. Maximum number of points for reports – 5 points * 12 reports – 60 points.
Evaluation criterion report:

" **Excellent** ": work done accurately, in full volume, at defense demonstrated complete and solid knowledge of the relevant material **The report** was submitted on time and all requirements for its preparation were met.	5 points

" **Good** ": the work contains minor inaccuracies, and during the defense, knowledge of the relevant material with minor inaccuracies was demonstrated. inaccuracies **Report –** submitted on time and all requirements for its preparation were met	4 points
" **Sufficient** ": The work contains some errors that are made due to negligence and lack of consistent skills, when defending the relevant material, the student's answer is incomplete or contains an inaccurate answer to theoretical questions **Report –** not submitted on time and not all requirements for its preparation were met	3 points
" **Unsatisfactory** ": the work contains fundamental errors, incomplete (incorrect) calculations, incomplete or inaccurate (incorrect) answers to theoretical questions. work **report was not submitted and not defended without a valid reason.**	0 points

8.2. Essay

Weighted score – 20 points.
The essay is evaluated according to the following criteria: relevance of the topic, completeness of coverage of the material, quality of the essay structure, compliance with accepted standards for scientific and technical materials, quality of the essay design. Each criterion is evaluated on a 5-point scale.

Criteria for evaluating the components of an essay

No	Essay	%	Weighted score	Number	Total
1.	Relevance of the essay topic	25	5	1	5
2.	Completeness of coverage of the material	25	5	1	5
3.	Quality of the essay structure, relevance accepted standards for scientific and technical materials	25	5	1	5
4.	Quality of essay design	25	5	1	5
	Total				20

8.3. Modular test work

The weighted score of the MTW is 20 points (4 tasks of 5 points each).
There are 4 tasks in the MTW in total. The weighted score of each task is 5 points. The maximum number of points for the MTW is 5 points x 4 tasks = 20 points.
The evaluation criterion for each MTW task according to the table:

No	Modular test work	%	Weighted score
1.	Complete and exhaustive answer (at least 90% of the required information)	100	5
2.	Minor errors in the answer (at least 75% of the required information)	75	4
3.	There are shortcomings in the answer and certain errors (at least 60% of the required information)	60	3
4.	The answer is missing or incorrect.	0	0

If academic dishonesty is detected during distance learning, the control measure is not taken into account, and the student is not allowed to defend his/her thesis.

***Calendar control** (CC) - Not conducted for 4th year students.*

In order to receive the highest rating, the student must: timely and qualitatively complete, prepare and

defend PC reports and an essay, and accordingly complete the MTW.

A student may appeal a teacher's grade by submitting a complaint to the teacher no later than the day after the student is informed of the grade. The complaint will be considered according to the procedures established by the university.

***Conditions for admission to semester control**: having at least 40 points and completing the MTW, and also implementation and protection all reports with PC and essay not Less, than on "enough".*

The student receives a credit without additional tests if the sum of the points scored is not less than by 60. Student, which in semester received more 60 points, but wants to increase your result, maybe take participation in credit control work or surveys on questions to the test. In this case, the final result consists of the points obtained in the test or in the survey.

Applicants, which completed all conditions admission to credit and have rating assessment Less 60 points make up credit control work (CCW). Final result consists of from points, that received on credit control work and with protection essay.

The final test is conducted at the final session.

The final test is evaluated out of 100 points and is determined as the sum of the points for the final test and the points for the individual semester assignment (essay). In this case, the size of the final test evaluation scale is reduced by the maximum value of points, foreseen by implementation essay (20 points). https://osvita.kpi.ua/node/37 (clause 3.12)

The test task on the final test consists of two parts: theoretical questions (3 questions);
practical task (1 task):
Based on the size of the scale RD = R test + R essay = 100 points
R test = RD - R essay = 100 - 20 = 80 points
Credit practical task – weighted score 20
Credit theoretical question – weighted score 20.

Maximum number points: 20 points x 1 practical tasks+20 points x 3 theor. question = 80 points

The criterion for evaluating a theoretical credit question is -	
" **Excellent** ", the answer is correct (at least 90% of the required information)	20-18 points
" **Good** ", there are minor errors in the answer (at least 75% of the required information)	17-15 points
" **Enough** ", there are shortcomings in the answer and certain errors (at least 60% of the required information).	14-12 points
"Unsatisfactory", the answer is missing or does not meet the requirements for "Satisfactory"	0 points

The criterion for evaluating the practical assignment is -	
" **Excellent** ", all task requirements are met (at least 90% of the required information)	20-18 points
" **Good** ", all requirements for the task are met, or there are minor errors (at least 75% of the required information)	17-15 points
" **Enough ",** there are shortcomings in fulfilling the requirements of the task and there are certain errors. (at least 60% of the required information).	14-12 points
"Unsatisfactory", the answer is missing or does not meet the requirements for "Satisfactory"	0 points

Table of correspondence of rating scores to university scale grades

Number points	**Score**
100-95	Excellent
94-85	Very good
84-75	Good
74-65	Satisfactory
64-60	Enough
Less 60	Unsatisfactory

Not fulfilled conditions admission	Not admitted

9. Additional information on the discipline (educational component)

List questions for preparation to modular control work, and also for preparation for the test are given in the appendix 1.

Distance learning through additional online courses on a specific topic is allowed subject to agreement with students. If a small number of students wish to take an online course on a specific topic, studying the material using such courses is allowed, but students must complete all the tasks provided for in the academic discipline. The list of courses is offered by the teacher after students express their desire (since the bank of available courses is updated almost monthly). The student provides a document confirming completion of the distance course (in the case of completing the full course) or provides completed practical tasks from the distance course and, subject to an oral interview with the teacher on the topics covered, can receive grades for the control measures provided for the topics studied.

Appendix 1 to the discipline syllabus
"Software Creation Technology"

List questions for preparation to modular control work, and also to prepare for credit

Question I

1. *To bring content 3-x crisis in industries software engineering and analyze their consequences for the development of software creation technologies products*
2. *List the software product life cycle models you know and their main features.*
3. *Briefly describe the classical (cascade, waterfall) software life cycle model product, its advantages and disadvantages in comparable with others models*
4. *Briefly describe the incremental software product life cycle model, its advantages and disadvantages compared to others models*
5. *Briefly describe the V-shaped software product life cycle model, its advantages and disadvantages compared to others models*
6. *Briefly describe the evolutionary model of the software product life cycle, its advantages and disadvantages compared to others models*
7. *Briefly describe the spiral model of the software product life cycle, its advantages and disadvantages compared to others models*
8. *Briefly describe the XP (extreme) software product life cycle model, its advantages and disadvantages compared to others models*
9. *What advantages in the technology of creating software products have emerged as a result of the use of reusable components, object-oriented programming, and the concept of the software life cycle? product?*
10. *Briefly describe the disciplines of software engineering engineering*
11. *Define the essence and purpose SWEBOK*
12. *Briefly define the content and purpose PMBOK*
13. *Analyze the main areas of knowledge of software engineering according to SWEBOK*
14. *Analyze the organizational knowledge areas of software engineering according to SWEBOK*
15. *To bring main standards software engineering and describe their connection with core SWEBOK knowledge*
16. *Explain what the software product life cycle is and describe the main life cycle processes*

Question II

1. *Describe the main sections of the terms of reference. What is the main purpose of the terms of reference? Who wrote it and for what purpose? is?*
2. *What such module? What such modularity system? What conditions should satisfy the ideal modulus and Why?*
3. *To reveal the principle of information privacy when designing software systems*
4. *What is the connectivity of the module? For what purposes is it calculated and what values (as large*

or as small as possible) should we strive for and Why?

5. *What is the coupling modulus? For what purposes is it calculated and what values should it be used for? strive?*
6. *As is being evaluated complexity software system?*
7. *Analyze and compare methods "ascending" developments" and "descending" development" of the software system, their advantages and disadvantages*
8. *Analyze and compare constructive and architectural methods of software system development, their advantages and disadvantages*
9. *Which exist types clutch modules in software systems? Their measures (i.e. by which parameter measured) and to what need strive at designing?*
10. *Explain, Why connectivity modules in software systems has be as much as possible, and the clutch - minimal*
11. *Explain the concept of "Unreliability" systems»*
12. *Define and compare "functional" requirements" and "non-functional" requirements" in technical specifications for software systems. Provide examples*
13. *Describe what is meant by the term "software support" product"*
14. *Describe diagram SADT, its appointment, main elements. To bring examples*
15. *Describe diagram ERD, its appointment, main elements. To bring examples*
16. *Describe diagram DFD, its appointment, main elements. To bring examples*
17. *Describe the USE CASE diagram, its purpose, and main elements. Give examples.*
18. *Analyze the main differences between structured and object-oriented programming methods*
19. *Compare the following software testing methods: "black box method", "white box method", "gray box method"*
20. *Define the concept of "CASE tools" in the technology of creating software products. For what purpose are they used? Give examples*

Question III

1. *Analyze the methods and tools you know for tuning (troubleshooting) when developing virtual devices in LabVIEW*
2. *Explain the differences between using Waveform graph and Waveform chart in LabVIEW*
3. *Analyze and compare the types of data that should be fed to the Waveform chart, Waveform graph, and XY-Graph graphs in LabVIEW*
4. *Describe what happens to the dimension of arrays on the input and output indexing tunnel of loops in LabVIEW (increases, decreases, or does not change).*
5. *Describe what an array is. What types of data (numeric, clusters, etc.) can be in arrays? And what types cannot?*
6. *What are the structures (Case, While Loop, For Loop) used for in LaвVIEW? Draw flowcharts of each of these structures*
7. *Can a While Loop in LabVIEW never execute? What about a For Loop? Explain*
8. *Explain how you understand the principle of data flow control in LabVIEW*
9. *Explain what a shift register is in a LabVIEW loop structure, what it is used for, and why it should be initialized*
10. *Justify the requirements for a LabVIEW virtual instrument to be used as a virtual sub-instrument*
11. *Describe the principle of operation of the error handling system in LabVIEW virtual instruments. What is an error cluster?*
12. *Explain the purpose of Time Stamp data in LabVIEW*
13. *Compare indexing and non-indexing tunnels in a loop structure in LabVIEW*
14. *Describe what a cluster is in LabVIEW. What elements can it be made of?*
15. *Explain what the function polymorphism property is in LabVIEW*

Question IV

NI LabVIEW Block Diagram Test Problem

Description of the material, technical and information support of the discipline

Educational and working program of the discipline, RSE, textbook (electronic edition), syllabus, online course in Moodle, practical classes, laboratory workshop.
URL: https://do.ipo.kpi.ua

The working program of the academic discipline (syllabus):
Compiled by Solomin A.V .;
Approved by the BME Department (Minutes No. 16 dated 06/21/2024)
Approved by the methodological committee of the faculty (minutes No. 9 dated 06/26/2024)