MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY
«KHARKIV POLYTECHNIC INSTITUTE»

Department _______ software engineering and management information technologies (name)

«CONFIRMED»
Head of commission ____________________________________________________________ (name)

(sign) _____________________ (last name and initials)

«_____»____________ 20_____ year

WORKING PROGRAM OF EDUCATIONAL DISCIPLINE

Technologies for the development of web-based systems (name of educational discipline)

level of higher education ___________ first (bachelor) first (bachelor) / second (master)

area of knowledge ___________ 12 Information technologies (code and title)

specialty ___________ 121 Software engineering (code and title)

specialization ________________________________________________ (code and title)

type of discipline ___________ professional education (common education / professional education)

form of study ___________ full-time (full-time / external)

Kharkiv – 2019 year
APPROVAL SHEET

Working program of educational discipline  

Fundamentals of databases  
(name of discipline)

Author:

*doctor of technical sciences, professor*  
(position, scientific degree and scientific rank)  
Volodymyr Aleksiyev  
(sign)  
(initials and last name)

Working program is considered and confirmed at the department’s meeting:

*software engineering and management information technologies*  
(name of department)

Protocol on « 29 » August 2018 year № 1

Head of department  

*SEMIT*  
(name of department)  
Godlevskyi M.D.  
(sign)  
(initials and last name)
**REAPPROVAL SHEET OF WORKING PROGRAM OF EDUCATIONAL DISCIPLINE**

<table>
<thead>
<tr>
<th>Date of department’s meeting – author of the working program</th>
<th>Protocol number</th>
<th>Head’s of department sign</th>
<th>Head’s of commission sign (for common educational disciplines and professional educational disciplines) or head’s of graduating department sign (for professional educational disciplines if the working program is designed by another department)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
GOAL, COMPETENCIES, LEARNING RESULTS AND STRUCTURE-LOGICAL SCHEME OF EDUCATIONAL DISCIPLINE LEARNING

**Goal:** formation of students’ theoretical and practical knowledge necessary for the design and implementation of web-based systems.

**Competencies:**

*Common competencies:*
- the ability to apply knowledge in practical situations;
- knowledge and understanding of the subject area and understanding of professional activity;
- the ability to learn and master modern knowledge;
- the ability to search, process and analyze information from different sources;

*Special (professional) competencies:*
- the ability to analyze subject areas (domains), formulate requirements, identify, classify and describe tasks, find methods and approaches to their solution;
- the ability to participate in software design for web-based systems, including simulation (formal description) of its structure, behavior and processes of operation.

**The normative content of the education of higher education graduates, formulated in terms of learning outcomes**

<table>
<thead>
<tr>
<th>Classification of competences</th>
<th>Knowledge</th>
<th>Skills</th>
<th>Communication</th>
<th>Autonomy and responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to analyze subject areas (domains), formulate requirements, identify, classify and describe tasks, find methods and approaches to their solution.</td>
<td>Know, understand, analyze, choose, and qualify the means of ensuring information security and integrity of data in accordance with the applicable application tasks and software systems.</td>
<td>Conduct a pre-project survey of the subject area, a systematic analysis of the design object.</td>
<td>Being able to apply the acquired knowledge creatively. Being able to work individually with minimal guidance, to manage own workload and time.</td>
<td>Know, understand and apply appropriate algorithmically concepts, methods of domain, system and object-oriented analysis and mathematical modeling for software development.</td>
</tr>
<tr>
<td>Classification of competences</td>
<td>Knowledge</td>
<td>Skills</td>
<td>Communication</td>
<td>Autonomy and responsibility</td>
</tr>
<tr>
<td>-------------------------------</td>
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<td>----------------------------</td>
</tr>
<tr>
<td>Ability to participate in the design of software, including simulation (formal description) of its structure, behavior and processes of operation.</td>
<td>Apply in practice instrumental software tools for domain analysis, design, testing, visualization, measurement and documentation of software.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Structural-logical scheme of studying the discipline**

<table>
<thead>
<tr>
<th>Previous disciplines:</th>
<th>Further disciplines:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamentals of object-oriented programming</td>
<td>Architecture and design of software</td>
</tr>
<tr>
<td>Basics of programming</td>
<td></td>
</tr>
</tbody>
</table>

**DESCRIPTION OF EDUCATIONAL DISCIPLINE**  
(distribution of study time by semesters and types of training sessions)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Total amount (hours) / credits of ECTS</th>
<th>Classes (hours)</th>
<th>Independent work (hours)</th>
<th>Lectures</th>
<th>Laboratory classes, seminars</th>
<th>Practice classes,</th>
<th>Individual tasks of students</th>
<th>Control works (number of works)</th>
<th>Current control</th>
<th>Semester control</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>180 / 6</td>
<td>96</td>
<td>84</td>
<td>48</td>
<td>48</td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ratio of the number of class hours to the total volume is 53.3% (%).
<table>
<thead>
<tr>
<th>№</th>
<th>Types of classes</th>
<th>Number of hours</th>
<th>Semester number (if the discipline is taught in several semesters). The names of content modules. Name of the topics and questions of each class. Task for independent work.</th>
<th>Literature (basic, auxiliary)Recommended</th>
</tr>
</thead>
</table>
| 1  | Lecture 4        | 4              | **Content module № 1 (Front-end Development of web-based systems)**  
**Topic 1.** Introduction to the client-server architecture of web-based systems. Theory and practice of Front-end and Back-end Development.  
[1 – 4],  
[10 – 19] | |
| 2  | Lecture 6        | 6              | **Topic 2.** Front-end Developer Tools. Wireframe, design and prototype. Learn Version Control.  
[1 – 4],  
[10 – 19] | |
[1 – 4],  
[10 – 19] | |
| 4  | Lecture 6        | 6              | **Topic 4.** Web page development using CSS3 technology. Standards for developing flexible, durable, and sustainable HTML and CSS. Working with the Box Model.  
[1 – 4],  
[10 – 19] | |
| 5  | Lecture 4        | 4              | **Topic 5.** Positioning Content. An Introduction to Grid Systems in Web Design.  
[4 – 7] | |
| 6  | Lecture 6        | 6              | **Topic 6.** Learn to Code Advanced HTML & CSS. Responsive Web Design. BEM (Block, Element, Modifier) is a component-based approach to web development.  
[4 – 7] | |
| 7  | Lecture 6        | 6              | **Content module № 2 (Development of interactive interfaces for web-based systems)**  
[4, 5] | |
| 8  | Lecture 6        | 6              | **Topic 5.** Introduction to Object-Oriented JavaScript.  
[4, 5] | |
<table>
<thead>
<tr>
<th>№</th>
<th>Types of classes</th>
<th>Number of hours</th>
<th>Name of the topics and questions of each class.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Express web framework (Node.js/JavaScript).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total (hours)</strong> 48</td>
</tr>
</tbody>
</table>

Semester number (if the discipline is taught in several semesters).

The names of content modules.

Name of the topics and questions of each class.

Task for independent work.

---

<table>
<thead>
<tr>
<th>№</th>
<th>Types of classes</th>
<th>Number of hours</th>
<th>Name of the topics and questions of each class.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lab.</td>
<td>10</td>
<td><strong>Content module № 1 (Front-end Development of web-based systems)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Topic 1. Web page development using HTML5 technology.</td>
</tr>
<tr>
<td>2</td>
<td>Lab.</td>
<td>10</td>
<td>Topic 2. Web page development using CSS3 technology.</td>
</tr>
<tr>
<td>3</td>
<td>Lab.</td>
<td>10</td>
<td><strong>Content module № 2 (Development of interactive interfaces for web-based systems)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Topic 3. Web page development using JavaScript</td>
</tr>
</tbody>
</table>
| №  | Types of classes | Number of hours | Task for independent work.  
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Lab.</td>
<td>10</td>
<td><strong>Topic 4.</strong> Introduction to Object-Oriented JavaScript.</td>
</tr>
<tr>
<td>5</td>
<td>Lab.</td>
<td>8</td>
<td><strong>Topic 5.</strong> Introduction to Server-side website programming using Node.js/JavaScript.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[4, 5], [10]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[6 – 9], [10]</td>
</tr>
</tbody>
</table>

Total (hours) 48
**INDEPENDENT WORK**

<table>
<thead>
<tr>
<th>№</th>
<th>The name of the type of independent work</th>
<th>Number of hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Workout of the lecture material</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>Preparation for laboratory classes</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Self-study of topics and issues that are not taught at lecture classes</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Preparation for midterm control</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Preparation for modular control</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Preparation for final control</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Work with an individual project</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>84</strong></td>
</tr>
</tbody>
</table>

**INDIVIDUAL TASKS**

**Themes of the development of the website in the framework of laboratory work**  
(individual task type)

1. Development of information support of a small business company;
2. Development of information support of an enterprise;
3. Development of information support of a nonprofit organization;
4. Development of a training course web page;
5. Personal portfolio web page development;
6. Develop a web page of the photographer;
7. Development of a personal blog web page (by topics);
8. E-commerce web page development;
9. Development of a web page with information on the study;
10. Develop a web page with information about the gadget;
11. Develop a web page with information about an upcoming event or meeting;
12. Development of promotional web page of the product or services provided;
13. Development of a web page with information about the timetable for the movement of buses (transport by type);
14. Development of a web page with information on programming courses in design, etc.;
15. Development of a web page for the department of an educational institution or university.

Other topics on the choice of students and coordinated with the teacher of the course.

**Literature:** basic [1 – 9]; auxiliary [10 – 19].
METHODS OF EDUCATION

When teaching the discipline for activating the educational process, the use of modern educational technologies is foreseen, such as: problem lectures; work in small groups; presentations; case method.

**Problem lectures** are aimed at developing the logical thinking of students. The topic of the lecture is limited to two or three key points, students focus on material that has not been widely reflected in the textbooks, the experience of foreign educational institutions is shared with the distribution of students during the lectures of the printed material and the main conclusions on the issues under consideration. When teaching lecture material, students are asked questions for self-reflection. In this case, the lecturer asks questions that urge the student to seek a solution to the problem situation. Such a system forces students to concentrate and begin to think actively in search of the correct answer.

At the beginning of the problem lecture, it is necessary to clearly formulate a problem that students need to address. When teaching lecture material, a direct answer to the questions should be avoided, and the lecture material should be covered in such a way that the student can use the information received to solve the problem.

**Mini-lectures** provide the presentation of a training material in a short period of time and are characterized by significant capacity, complexity of logical constructions, images, evidence and generalizations. Mini-lectures are held, as a rule, as part of a study-study. At the beginning of the mini-lecture on these topics, the lecturer emphasizes the students' need to present the lecture material outlined in the so-called structural-logical form. Questions are considered, which are fixed in the lecture plan, but they are summarized briefly. Lecture sessions conducted in this way awaken the student’s activity and attention in the perception of the material, and also direct him to use a systematic approach when reproducing the information he received from the teacher. Problem lectures and mini-lectures should be combined with such a form of activation of the educational process, as work in small groups.

**Work in small groups** makes it possible to structure lecture or laboratory classes in form and content, creates opportunities for each student to participate in the work on the topic of classes, and provides the formation of personal qualities and experience of social communication. After illuminating the problem (using problematic lectures) or the brief teaching of the material (using mini-lectures), students are invited to be grouped into groups of 5-6 people and to present their vision and perception of the material at the end of the lesson.

**Presentations** – presentations to the audience, used to present certain achievements, group performance, report on the performance of individual tasks. One of the positive features of the presentation and its benefits when used in the learning process is the exchange of experience that students gained while working in a particular small group.

**Case method** – a method for analyzing specific situations that allows the process of learning to be brought closer to the practical work of specialists and involves consideration of production, managerial and other situations, complex conflicts, problem situations, incidents in the process of studying educational material.
METHODS OF CONTROL

The system for assessing students' knowledge, skills and abilities requires rating of all forms of conducting classes. Examination and assessment of students' knowledge can be carried out in the following forms:

1. Evaluation of students’ work in the process of practical and laboratory studies.
2. Midterm control.
3. Modular control.

The overall modular assessment consists of the current assessment that the student receives during practical and laboratory training and assessment for the implementation of modular control work.

The overall assessment of discipline is defined as the arithmetic average of the modular estimates (including credits).

The order of the current assessment of students’ knowledge
The current evaluation is carried out during the laboratory lessons and aims to check the level of preparedness of the student to perform specific work. The objects of current control are:

1) the activity and performance of the student during the semester over the study of the program material of the discipline; attending classes;
2) implementation of midterm control;
3) implementation of the modular control task.

Control of systematic performance of independent work and activity in laboratory classes
The assessment is based on the 5-point scale according to the following criteria:

1) understanding, the degree of assimilation of theory and methodology of problems that are considered;
2) the degree of mastering the material of discipline;
3) acquaintance with the recommended literature, as well as contemporary literature on the issues under consideration;
4) the ability to combine theory with practice when considering production situations, solving tasks, performing calculations when performing tasks performed for self-study, and assignments that are submitted for consideration in an auditorium;
5) logic, structure, style of presentation of the material in written works and speeches in the audience, ability to substantiate their position, to generalize information and to draw conclusions.

The grade is "excellent" if the student fulfills the task or his or her oral answer to all five specified criteria.

The absence of one or another component reduces the score to the corresponding number of points.

When evaluating laboratory tasks, attention is also paid to their quality and independence, timeliness of delivery of the tasks performed to the teacher (according to the schedule of the educational process). If any of the requirements are not met, the score will be lowered.

Intermediate modular control
Intermediate modular control of the level of knowledge involves identifying the student's acquisition of the material of the lecture module and the ability to apply it to solve the practical situation and is conducted in the form of testing. In this case, the test task may contain both questions relating to purely theoretical material and questions aimed at solving a small practical task.

The test task contains the questions of single and multiple choice of different difficulty levels. To assess the level of student responses to test assignments, the following evaluation criteria are used:
Tests for interim control are selected from the general list of tests for the corresponding modules.

**Modular control**

Modular control is carried out and evaluated by two components: a lecture (theoretical) module and a practical module.

Theoretical modular control is carried out in writing after all theoretical material is considered. After studying topics 1 – 6 (module 1), full-time students complete – task to module 1. Accordingly, after studying topics 7 – 9 (module 2) – task to module 2.

Practical modular control carries out after performed laboratory tasks within each of two modules, taking into account the protected laboratory reports.

The theoretical modular task is assessed by a 12-point system in accordance with the qualification requirements for bachelors of specialty 121 "Software Engineering". At the same time it is considered that for the set of 1 point of evaluation it is necessary to correctly answer 2 questions of the task to the module.

The final score from the discipline is calculated as the average of several components, which takes into account the estimates of each type of control (two grades based on the results of the current module control over the work during the semester).
**DISTRIBUTION OF SCORES OBTAINED BY STUDENTS AND THE SCALE OF ASSESSMENT OF KNOWLEDGE AND SKILLS (NATIONAL AND ECTS)**

Table 1. Distribution of scores to assess the current student’s progress

<table>
<thead>
<tr>
<th>Content module 1</th>
<th>Content module 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>10</td>
</tr>
</tbody>
</table>

T1, T2, ... – numbers of topics of the content modules.

Table 2. Scale of knowledge and skills assessment: national and ECTS

<table>
<thead>
<tr>
<th>The amount of points for all types of educational activities</th>
<th>Assessment according to ECTS</th>
<th>Assessment according to a national scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 ... 100</td>
<td>A</td>
<td>excellent</td>
</tr>
<tr>
<td>82 ... 89</td>
<td>B</td>
<td>good</td>
</tr>
<tr>
<td>74 ... 81</td>
<td>C</td>
<td>satisfactorily</td>
</tr>
<tr>
<td>64 ... 73</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>60 ... 63</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>35 ... 59</td>
<td>FX</td>
<td>unsatisfactory with the possibility of re-assembly</td>
</tr>
<tr>
<td>0 ... 34</td>
<td>F</td>
<td>unsatisfactorily with mandatory repeated study of discipline</td>
</tr>
</tbody>
</table>
RECOMMENDED LITERATURE

Basic literature


Auxiliary literature

INFORMATIONAL RESOURCES ON INTERNET


2. The World Wide Web Consortium (W3C) [Electronic resource]. – Access mode: https://www.w3.org/


11. Nodeschool. Open source workshops that teach web software skills. Do them on your own or at a workshop nearby [Electronic resource]. – Access mode: https://nodeschool.io/