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

Кафедра програмного забезпечення комп'ютерних систем

MULTIMEDIA INTERFACES AND 3D VISUALIZATION

Syllabus

Details of the educational component

Level of higher education	***Second (Master)***
Branch of knowledge	*12 Information Technologies*
Specialty	*121 Software Engineering*
Educational program	*Software Engineering of Multimedia and Information-Retrieval Systems*
Status of the educational component	*Normative*
Form of education	*Full-time*
A year of training	*1 year, Autumn semester*
The scope of the educational component	*Lectures: 36 academic hours, computer class: 18 academic hours, student's self-training: 66 academic hours.*
Semester control / control measures	*Final test, midterm test*
Schedule of classes	*According to the schedule for the autumn semester of the current academic year (rozklad.kpi.ua)*
Language of instructions	*English*
Information about head of the course / teachers	*DSc, assoc. prof. Yevgeniya Sulema, sulema@pzks.fpm.kpi.ua*
Course location	Google classroom. Access is given to registered students.

Program of educational component

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

The purpose *of studying the discipline "Multimedia interfaces and 3D visualization" is to develop in students the ability to independently develop software that implements the latest multimedia user interfaces and 3D visualization tools.*

The subject *of the discipline "Multimedia interfaces and 3D visualization" is the hardware and software of the processes of presentation, transformation and reproduction of multimedia information.*

Studying the discipline "Multimedia interfaces and 3D visualization" allows students to develop the ***competencies*** *necessary for solving practical tasks of professional activity related to the development of the latest multimedia user interfaces and the development of 3D visualization tools:*

PC12 – Ability to design complex multimedia and information retrieval systems;

PC19 – Ability to design multimedia software interfaces.

The program results *of the discipline "Multimedia interfaces and 3D visualization":*

PLO04 – Identify information needs and classify data for software design;

PLO07 – Analyze, evaluate and apply at the system level modern software and hardware platforms to solve complex problems of software engineering;

PLO32 – Be able to develop multimedia systems and interfaces;

PLO33 – Be able to develop software for 3D visualization systems.

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

The successful study of the discipline "Multimedia interfaces and 3D visualization" is preceded by the study of the disciplines "Programming", "Object-oriented programming", "Mathematical analysis", "Linear algebra and analytical geometry" of the curriculum for bachelors in the specialty 121 Software engineering.

The theoretical knowledge and practical skills acquired during the mastering of the discipline "Multimedia interfaces and 3D visualization" can be used during the preparation of a master's thesis.

3. **Content of the academic discipline**

The discipline "Multimedia interfaces and 3D visualization" involves studying the following topics:

Topic 1. Introduction to the newest multimedia interfaces and 3D visualization

Topic 2. Voice interfaces

Topic 3. Gesture interfaces

Topic 4. 3D visualization

Modular control work

Test

4. **Educational materials and resources**

Basic literature:

1. Educational and methodological materials for the educational component "Multimedia interfaces and 3D visualization".
Use to master practical skills in the discipline. The materials are in Google classroom. Access is granted to registered students.

Additional literature:

1. Najim M. Digital Filters Design for Signal and Image Processing. ISTE USA, 2006, 369 p.
Use to master practical skills in the discipline. Materials are available upon request.

2. Wen Zh., Huang T. S. 3D Face Processing. Kluwer Academic Publishers, 2004, 137 p.
Use to master practical skills in the discipline. Materials are available upon request.

Educational content

5. **Methods of mastering the educational component**

No.	*Type of training session*	*Description of the training session*
Topic 1. Introduction to the newest multimedia interfaces and 3D visualization		
1	*Lecture 1. Introduction to multimedia interfaces and 3D visualization (4 academic hours)*	*The history of the development of multimedia, multimedia and immersive technologies. Fields of application of multimedia interfaces and 3D visualization. Types of the latest multimedia interfaces. Task for self-training: item 6, No. 1.*
Topic 2. Voice interfaces		

2	*Lecture 2. Voice human-machine interaction (2 academic hours)*	*Types of human-machine interaction. Voice assistants. Classification of voice interfaces. Principles of building voice assistants. Task for self-training: item 6, No. 2.*
3	*Lecture 3. Digital signal processing: basic operations and procedures (2 academic hours)*	*Problems of digital signal processing. The main types of signals. Basic operations. Basic procedures. Task for self-training: item 6, No. 3.*
4	*Lecture 4. Digital signal processing: Z-transformation (2 academic hours)*	*Direct Z-transformation. Inverse Z-transform. Application of Z-transformation. Diagram of poles and zeros. Task for self-training: item 6, No. 4.*
5	*Lecture 5. Digital signal processing: digital filters (4 academic hours)*	*The problem of digital filtering. Classification of digital filters. Filters with infinite impulse response. Filters with infinite impulse response. Task for self-training: item 6, No. 5.*
6	*Lecture 6. Voice signal recognition (4 academic hours)*	*Stages of the voice signal recognition procedure. Application of neural networks. Task for self-training: item 6, No. 6.*
7	*Lecture 7. Development of a voice interface (4 academic hours)*	*Voice interface functionality. Gathering requirements for voice command processing software. Basic principles of voice interface development. Task for self-training: item 6, No. 7.*
Topic 3. Gesture interfaces		
8	*Lecture 8. Recognition and processing of gestures (4 academic hours)*	*Types of gesture interfaces. Stages of the gesture recognition procedure. Stages of the gesture processing procedure. Task for self-training: item 6, No. 8.*
9	*Lecture 9. Recognition of user emotions (2 academic hours)*	*Application of emotion recognition. Basic principles of emotion recognition. Stages of the emotion recognition procedure. Task for self-training: item 6, No. 9.*
Topic 4. 3D visualization		
10	*Lecture 10. 3D visualization hardware (2 academic hours)*	*Classification of 3D visualization hardware. Principles of functioning of 3D visualization hardware. Task for self-training: item 6, No. 10.*
11	*Lecture 11. 3D visualization software (2 academic hours)*	*Principles of 3D visualization software development. Task for self-training: item 6, No. 11.*
12	*Lecture 12. 3D visualization technology (2 academic hours)*	*Stages and procedures of 3D visualization technology. Task for self-training: item 6, No. 12.*
13	*Computer workshop 1. Technical 3D modeling (8 academic hours)*	*Task: Develop a 3D model of a technical object according to the variant number. Task for self-training: item 6, No. 13.*

14	*Computer workshop 2. 3D human modeling (10 academic hours)*	*Task: Develop a 3D model of your own image. Task for self-training: item 6, No. 14.*
Test		

6. Student's self-training

The discipline "Multimedia interfaces and 3D visualization" is based on self-training for classroom classes on theoretical and practical topics.

No.	*The topic assigned for self-training*	*Number of hours*	*Literature*
1	*Preparation for the lecture 1*	*2*	*1*
2	*Preparation for the lecture 2*	*1*	*1*
3	*Preparation for the lecture 3*	*1*	*1; 2, pp. 18-35*
4	*Preparation for the lecture 4*	*1*	*1; 2, pp. 38-67*
5	*Preparation for the lecture 5*	*2*	*1; 2, pp. 154-206*
6	*Preparation for the lecture 6*	*2*	*1*
7	*Preparation for the lecture 7*	*2*	*1*
8	*Preparation for the lecture 8*	*2*	*1*
9	*Preparation for the lecture 9*	*1*	*1*
10	*Preparation for the lecture 10*	*1*	*1*
11	*Preparation for the lecture 11*	*1*	*1; 3, pp. 11-38*
12	*Preparation for the lecture 12*	*1*	*1; 3, pp. 41-59*
13	*Preparation for the computer workshop 1*	*20*	*1*
14	*Preparation for the computer workshop 2*	*20*	*1*
15	*Preparation for the midterm test*	*3*	*1; 2, pp. 18-35, 38-67, 154-206; 3 pp. 11-38, 41-59*
16	*Preparation for the final test*	*6*	*1; 2, pp. 18-35, 38-67, 154-206; 3 pp. 11-38, 41-59*

Policy and control

7. Policy of academic educational component

- *Attending computer workshop classes may be occasional and as needed to protect computer workshop work.*
- *Rules of behavior in classes: activity, respect for those present, turning off phones.*
- *Adherence to the policy of academic integrity.*
- *Rules for protecting the works of the computer workshop: the works must be done according to the option of the student, which is determined by his number in the group list.*

- *The rules for assigning incentive points are as follows. Incentive points are awarded for: a creative approach in the performance of computer workshop works (the maximum number of points for all works is 5 points).*

8. Rating system for evaluating learning outcomes

During the semester, students perform 2 computer workshops.

The maximum number of points for each computer workshop: 25 points.

Points are awarded for:
- quality of laboratory work (computer workshop): 0-20 points;
- answer during the defense of laboratory work (computer workshop): 0-3 points;
- timely presentation of work for defense: 0-2 points.

Performance evaluation criteria:
19-20 points – the work is done qualitatively, in full;
10-18 points – the work is done qualitatively, in full, but has shortcomings;
1-9 points – the work is completed in full, but contains minor errors;
0 points – the work is incomplete or contains significant errors.

Answer evaluation criteria:
3 points – the answer is complete, well-argued;
2 points – the answer is generally correct, but has flaws or minor errors;
1 point – there are significant errors in the answer;
0 points – there is no answer or the answer is incorrect.

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

The maximum number of points for performing and defending computer practicals:
25 points + 25 points = 50 points.

The assignment for the modular test consists of 10 questions. The answer to each theoretical question is evaluated by 0-5 points.

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

The maximum number of points for a modular control work:
5 points × 10 questions = 50 points.

The rating scale for the discipline is equal to:
R = RS = 50 points for the computer workshop + 50 points of the MKR = 100 points.

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

At the first certification (8th week), the student receives "credited" if his current rating is at least 12 points (50% of the maximum number of points a student can receive before the first certification).

At the second certification (14th week), the student receives "passed" if his current rating is at least 20 points (50% of the maximum number of points a student can receive before the second certification).

Semester control: test.

Conditions for admission to semester control:

With a semester rating (r_C) of not less than 60 points and the enrollment of all computer practical work, the student receives credit "automatically" according to the table (see the Table of correspondence of rating points to grades on the university scale). Otherwise, he has to perform the final control work.

Completion and protection of a computer workshop is a necessary condition for admission to the credit control work.

If the student does not agree with the "automatic" grade, he can try to improve his grade by writing a credit test, while his points received for the semester are kept, and the better of the two grades received by the student is assigned ("soft" grading system).

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

Scores	*Rating*
100-95	Excellent
94-85	Very Good
84-75	Good
74-65	Satisfactory
64-60	Fair
Less than 60	Unsatisfactory
Admission conditions not met	Not allowed

The syllabus prepared by DSc, assoc. prof. Yevgeniya Sulema.

Approved by the PZKS department (protocol No. 13 dated 22.06.2022).

Approved by the Methodical Commission of the Faculty of Applied Mathematics (protocol No. 9 dated 24.06.2022).