МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ

ХАРКІВСЬКИЙ НАЦІОНАЛЬНИЙ ЕКОНОМІЧНИЙ УНІВЕРСИТЕТ

ІМЕНІ СЕМЕНА КУЗНЕЦЯ

ЗАТВЕРДЖЕНО
на засіданні кафедри
інформаційних систем
Протокол № 1 від 22.08.2023 р.

ПОГОДЖЕНО
Проректор з навчально-методичної роботи

_____ Каріна НЕМАШКАЛО

КОМП'ЮТЕРНА ГРАФІКА ТА ВІЗУАЛІЗАЦІЯ
робоча програма навчальної дисципліни (РПНД)

Галузь знань	**12 «Інформаційні технології»**
Спеціальність	**121 «Інженерія програмного забезпечення»**
Освітній рівень	**перший (бакалаврський)**
Освітні програми	**Інженерія програмного забезпечення**

Статус дисципліни	**вибіркова**
Мова викладання, навчання та оцінювання	**англійська**

Розробник:
к.е.н., доцент   підписано КЕП   **Євген ГРАБОВСЬКИЙ**

Завідувач кафедри
інформаційних систем

_____   **Дмитро БОНДАРЕНКО**

Гарант програми   _____   **Олег ФРОЛОВ**

Харків
2024

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SIMON KUZNETS KHARKIV NATIONAL UNIVERSITY OF
ECONOMICS

APPROVED
at the meeting of the department
information systems
Protocol № 1 of 22.08.2023

AGREED
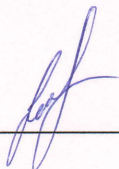Vice-rector for educational and methodical
work

_____ Karina NEMASHKALO

COMPUTER GRAPHICS AND VISUALIZATION
Program of the course

Field of knowledge	**12 "Information technologies"**
Specialty	**121 "Software engineering"**
Study cycle	**first (undergraduate)**
Study programme	**Software engineering**

Course status	**elective**
Language	**English**

Developers:
PhD, associate professor
Professor   digital signature   Yevhen HRABOVSKYI

Head of Department
information systems   _____ Dmytro BONDARENKO

Head of Study
Programme   _____ Oleg FROLOV

Kharkiv
2024

INTRODUCTION

Professional knowledge of computer graphics editors, in particular raster graphics editors, is of great importance at the stage of image preparation for publication. To work with programs, it is necessary to know not only the capabilities of a specific command or tool, but also the basics of color theory, raster and vector graphics, the essence of image processing processes, to have an idea of tonal and color correction, etc.

The course "Computer graphics and visualization" ensures the development of knowledge, skills and improvement in the field of computer graphics, provides an opportunity to learn the methods of preparing graphic images. In the process of studying this discipline, applicants will get acquainted with the possibilities of creating logos, business cards and trademarks, receive, edit and improve images.

In order to acquire practical skills in the discipline, applicants must work with the raster editor Adobe Photoshop.

The study of the course "Computer graphics and visualization" is studied by students of the "Software engineering" specialty of all forms of education in the third year during the fifth semester.

The purpose of teaching this educational discipline is to form students a system of theoretical knowledge, applied skills and practical skills in the application of computer design technologies using computer graphics editors.

The tasks of the course are:

mastering the skills of preparing images using bitmap editors of computer graphics;

the ability to improve the quality of digital images.

The object of the course is digital images.

The subject of the course is the main approaches and methods of developing and implementing computer design technologies that provide solutions to tasks in the field of Web technologies.

In the process of training, students acquire the necessary knowledge during lectures and performing laboratory work. Independent work of students is also of great importance in the process of studying and consolidating knowledge. All types of classes are developed in accordance with the transfer system of the organization of the educational process.

The learning outcomes and competencies formed by the course are defined in table 1.

Table 1

Learning outcomes and competencies formed by the course

Learning outcomes	Competencies
LO07. To know and apply in practice the fundamental concepts, paradigms and basic principles of functioning of language, tool and computing software engineering tools.	SC08. Ability to apply fundamental and interdisciplinary knowledge to successfully solve software engineering problems.

LO08. Be able to develop a human-machine interface.	
LO14. Apply in practice software tools for domain analysis, design, testing, visualization, measurement and documentation of software.	
LO18. Know and be able to apply information technologies for data processing, storage and transmission	SC01. Ability to identify, categorize and formulate software requirements.

COURSE CONTENT

Content module 1. The technology of creating images of raster graphics

Topic 1. Graphic images
1.1. General concepts about graphic images
1.2. Types of computer graphics
1.3. The technology of using RGB, CMYK, HSB, Lab color models

Topic 2. The technology of using raster images
2.1. Determination of geometric dimensions of raster images
2.2. Changing the canvas size.
2.3. Crop tool.
2.4. Automatic cropping and alignment.
2.5. Definition of memory for storing bitmap images
2.6. Convert image types

Topic 3. Technology of selection of areas in the image
3.1. Peculiarities of selection operation in raster images
3.2. Selection of areas of different shape on the image.
3.3. Means of automatic selection of objects.
3.4. Selection operations.
3.5. Application of transformations

Content module 2. Raster image processing technology

Topic 4. Technology of tone correction of images
4.1. Terms.
4.2. Tone correction methods using levels.
4.3. Using tone curves when correcting images.
4.4. Automatic tone correction.

Topic 5. Color image correction technology
5.1. General information about color correction.
5.2. Tonal correction of color images.
5.3. Color correction and balancing.
5.4. Automatic color correction.
5.5. Adjustment layers.

Topic 6. Technology of using vector objects and fonts
6.1. Contour application technology.
6.2. Actions with contours and subcontours.
6.3. Technology of working with text.
6.4. Raster text.

Topic 7. Technology of image quality improvement
7.1. Retouch.
7.2. Enhancement of image clarity.
7.3. Defocus - blurring of the image.
7.4. Restoration and correction of fragments.
7.5. Tonal and color correction of image fragments   .
7.6. Creating panoramas.

Topic 8. Image preparation technology for the Web
8.1. The size of images for a Web page.
8.2. Ways to optimize images.
8.3. Link maps.

The list of laboratory studies in the course is given in table 2.

Table 2

The list of laboratory studies

Name of the topic and/or task	Content
Topic 1. Task 1.	Getting to know the environment of the Photoshop graphic editor
Topic 2. Task 2.	Control size and resolution in Photoshop. Image conversion.
Topic 3. Task 3.	Resize, rotate, crop the image.
Topic 4. Task 4.	Selection of areas in the image
Topic 5. Task 5.	Application of masks and alpha channels
Topic 6. Task 6.	Using layers to create collages
Topic 7. Task 7.	Tonal correction
Topic 8. Task 8.	Correction of color images
Topic 8. Task 9.	Creating a mobile application design using Figma

The list of self-studies in the course is given in table 3.

Table 3

List of self-studies

Name of the topic and/or task	Content
Topic 1-8	Studying lecture material
Topic 1-8	Preparation for laboratory classes

The number of hours of lectures, laboratory classes, and hours of self-study is given in the technological card of the course.

TEACHING METHODS

In the process of teaching an educational discipline, in order to acquire certain learning outcomes, to activate the educational process, it is envisaged to use such learning methods as:

Verbal (lecture (Topic 1, 3, 5, 6, 7, 8), problematic lecture (Topic 2), provocative lecture (Topic 4)).

In person (demonstration (Topic 1-8)).

Practical (laboratory work (Topic 1 - 8), case method (Topic 4)).

FORMS AND METHODS OF ASSESSMENT

The University uses a 100-point cumulative system for assessing the learning outcomes of students.

Current control is carried out during lectures and laboratory classes and is aimed at checking the level of readiness of a higher education applicant to perform a specific job and is evaluated by the sum of points scored:

− for disciplines with a form of semester control examination (exam): the maximum amount is 60 points; the minimum amount that allows a student of higher education to pass an exam is 35 points.

The final control includes the semester control and certification of the student of higher education.

Semester control is conducted in the form of a semester exam (exam).

The maximum number of points that a student of higher education can receive during the examination (examination) is 40 points. The minimum amount for which the exam is considered passed is 25 points.

The final grade for the course is determined by summing the points for the current and final control.

During the teaching of the course, the following control measures are used:

Current control: protection of laboratory works (50 points), current control works (10 points).

More detailed information about the evaluation system is given in the work plan (technological map) for the course.

An example of an exam card and assessment criteria.

Simon Kuznets Kharkiv National University of Economics
First (bachelor) level of higher education
Specialty "Software Engineering"
Educational and professional program "Software engineering".
The course " Computer graphics and visualization "

Task 1 (stereotype).
1. The dimensions of the image in pixels are 400 x 600.
a) determine the dimensions of the image in centimeters when displayed on a monitor with a

resolution of 102 dpi.
b) determine the file size in megabytes in CMYK mode.
c) determine the size of the file in kilobytes in bit format
2. Determine the color depth if the maximum number of reproducible colors is 2.
Give the necessary formulas and calculations.

Task 2 (Heuristic).
Using a layer mask, make a collage with a smooth transition from one image to another (appendix 3 to the ticket). Explain the performed actions. Save files in *.psd format

Task 3 (Heuristic).
Carry out tonal correction of the given image using correcting layers (appendix 4 to the ticket). Explain the performed actions. Save files in *.psd format.

Task 4 (Heuristic).
Carry out tonal correction of the given image using correction layers (Appendix 4 to the ticket). Explain the performed actions. Save files in *.psd format.

Approved at the meeting
department of information systems
Protocol No. __ of "__"____ 202

Examiner   Yevhen HRABOVSKYI

Head of department   Dmytro BONDARENKO

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Evaluation criteria
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The final marks for the exam consist of the sum of the marks for the completion of all tasks, rounded to a whole number according to the rules of mathematics.
The algorithm for solving each task includes separate stages that differ in complexity, time-consumingness, and importance for solving the task. Therefore, individual tasks and stages of their solution are evaluated separately from each other as follows:

The overall examination grade is given according to the 40-point system and consists of five grades according to the formula:

$$OE = K_1 xOC_1 + K_2 xOC_2 + K_3 xOC_3 + K_4 xOC_4,$$

where
K_1, K_2, K_3, K_4 – degree of completion of the K-th task – $K_i=(0...1)$;
OC_1 – the maximum mark for task 1. $OC_1 = 8$;
OC_2 – the maximum score for task 2. $OC_2 = 11$;
OC_3 – the maximum score for task 3. $OC_3 = 10$;
OC_4 – the maximum mark for task 4. $OC_4 = 11$

K1=1   all calculations are completed completely, without errors. Explanations and formulas are necessary.
K1=0.75, all calculations are completed completely, without errors. Not all necessary explanations and formulas are given. Sloppy results:
K1=0.5   , all calculations are completed in full, there are minor errors in the calculations. Not all necessary explanations and formulas are given.
K1=0.25, not all calculations are performed, there are minor errors in the calculations. Necessary explanations are not given. Untidy results;
K1=0   calculations are not performed, or there are significant errors in the calculations.

K2=1   task completed completely, without errors. The optimal image creation technology is used. Explanations are necessary.

K2=0.75   the task is completed, but the technology used is not optimal. Explanations are necessary
K2=0.5   task completed, without critical errors. Necessary explanations are not provided;
K2=0.25   the task is incompletely completed, without critical errors. Necessary explanations are not given;
K2=0   task not completed or completed with critical errors.

K3=1   task completed completely, without errors. The optimal image creation technology is used. Explanations are necessary.
K3=0.75   the task is completed, but the technology used is not optimal. Explanations are necessary
K3=0.5   task completed, without critical errors. Necessary explanations are not given;
K3=0.25   the task is incompletely completed, without critical errors. Necessary explanations are not given;
K3=0   task not completed or completed with critical errors.

K4=1   task completed completely, without errors. The optimal image creation technology is used. Explanations are necessary.
K4=0.75   the task is completed, but the technology is not optimal. Explanations are necessary
K4=0.5   task completed, without critical errors. Necessary explanations are not given;
K4=0.25   the task is incompletely completed, without critical errors. Necessary explanations are not provided;
K4=0   task not completed or completed with critical errors.

RECOMMENDED LITERATURE

Main

1. Веселовська, Г. В. Комп'ютерна графіка: навч. посіб. для студентів ВНЗ / [Текст] // Г. В. Веселовська, В. Є. Ходаков, В. М. Веселовський; під ред. В. Є. Ходаков. – Херсон : ОлдіПлюс, 2019. – 581 с.

2. Євсєєв, О. С. Створення інтерактивних медіа [Електронний ресурс] : навч. посіб. / О. С. Євсєєв ; Харківський національний економічний університет ім. С. Кузнеця. – Харків : ХНЕУ ім. С. Кузнеця, 2020. – 138 с. http://www.repository.hneu.edu.ua/handle/123456789/24522

3. Проєктування додатків для мобільних пристроїв [Електронний ресурс] : навчальний посібник / О. І. Пушкар, Є. М. Грабовський; Харківський національний економічний університет ім. С. Кузнеця. — Електрон. текстові дан. (14,6 МБ). — Харків : ХНЕУ ім. С. Кузнеця, 2023. — 166 с. : іл. — Загол. з титул. екрану. — Бібліогр.: с. 163-164. http://www.repository.hneu.edu.ua/handle/123456789/30156

Additional

4. Бережна О. Б. Принципи побудови адаптивного інтерфейсу мультимедійних додатків / О. Б. Бережна // Поліграфія і видавнича справа. – 2022. – № 1 (83). – С. 80-87. http://repository.hneu.edu.ua/handle/123456789/28382

5. Власій О. О. Комп'ютерна графіка. Обробка растрових зображень: Навчально-методичний посібник / О. О. Власій, О. М. Дудка. Івано-Франківськ: ДВНЗ «Прикарпатський національний університет імені Василя Стефаника», 2021. 72 с.

6. Al'boschiy, O., Dorokhov, O., Hrabovskyi, Y., Naumenko, M. Automated balancing method of vector illustration and its software implementation. Bulletin of

the Transilvania University of Brasov, Series III: Mathematics and Computer Science, 2022, 2(1), pp. 177–192.

7. Hrabovskyi Ye. M. The methodology of developing a mobile application design for creating a genealogical tree / Ye. M. Hrabovskyi, Yu. D. Brusiltseva // Поліграфія і видавнича справа. – 2022. — № 1 (83). – С. 66-79. http://www.repository.hneu.edu.ua/handle/123456789/28383

8. Грабовський Є.М., Кірєєва Ю.О. Методика оформлення презентації проекту на behance (на прикладі дизайну LMS). Наукові записки [Української академії друкарства]. 2022. № 2 (65). С. 78-95. http://repository.hneu.edu.ua/handle/123456789/29385

9. Hrabovskyi, Y , Kots, P. Methodology for designing a mobile application for people with an active lifestyle. Поліграфія і видавнича справа. 2022 № / 2 (84) С. 22-35. http://repository.hneu.edu.ua/handle/123456789/29386

10. Hrabovskyi Y., Yevsyeyev O., Pandorin A. Development of a method for the creation of 3D advertising printing products, Eastern-European Journal of Enterprise Technologies, № 6/2 (96), pp. 6 – 18, 2018.

11. Hrabovskyi Y., Brynza N., Vilkhivska O. Development of information visualization methods for use in multimedia applications. EUREKA: Physics and Engineering. 2020. № 1. Pp. 3–17.

12. Fundamentals of Computer Graphics. Fourth Edition / S. Marschner, P. Shirley – CRC Press, 2019. – ISBN: 9781482229417

Information resources

13. Сайт персональної навчальної системи з навчальної дисципліни «Комп`ютерна графіка та візуалізація» . – Режим доступу: https://pns.hneu.edu.ua/course/view.php?id=5003

14. D.Eck. Introduction to computer graphics. – Режим доступу до ресурсу: http://math.hws.edu/graphicsbook/

15. Joey de Vries. Welcome to OpenGL. – Режим доступу до ресурсу: https://learnopengl.com/