SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Computer Science
1.4 Field of study	Computer Science and Information Technology
1.5 Cycle of study	Bachelor of Science
1.6 Program of study / Qualification	Computer science / Engineer
1.7 Form of education	Full time
1.8 Subject code	36.

2. Data about the subject

2.1 Subject name				***Graphic Processing***	
2.2 Course responsible / lecturer				Prof. dr. eng. Gorgan Dorian - dorian.gorgan@cs.utcluj.ro	
2.3 Teachers in charge of seminars / laboratory / project				Assoc. prof. dr. eng. Bacu Victor - victor.bacu@cs.utcluj.ro Lect. dr. eng. Adrian Sabou - adrian.sabou@cs.utcluj.ro Lect. dr. eng. Constantin Nandra - constantin.nandra@cs.utcluj.ro	
2.4 Year of study	III	2.5 Semester	1	2.6 Type of assessment (E - exam, C - colloquium, V - verification)	E
2.7 Subject category	*DF – fundamentală, DD – în domeniu, DS – de specialitate, DC – complementară*				DD
	DI – Impusă, DOp – opțională, DFac – facultativă				DI

3. Estimated total time

3.1 Number of hours per week	4	of which:	Course	2	Seminars		Laboratory	2	Project	
3.2 Number of hours per semester	56	of which:	Course	28	Seminars		Laboratory	28	Project	
3.3 Individual study:										
(a) Manual, lecture material and notes, bibliography										20
(b) Supplementary study in the library, online and in the field										6
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										10
(d) Tutoring										3
(e) Exams and tests										5
(f) Other activities:										0

3.4 Total hours of individual study (suma (3.3(a)…3.3(f)))	44
3.5 Total hours per semester (3.2+3.4)	100
3.6 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 Curriculum	Computer programming (C language) Elements of Computer Assisted Graphics
4.2 Competence	Applications development in C programming language, Graphical systems architecture, The graphical processing pipeline

5. Requirements (where appropriate)

5.1. For the course	Projector, computer
5.2. For the applications	Laboratory attendance is mandatory Study of laboratory materials from the server

6. Specific competence

6.1 Professional competences	**C4 –** Improving the performances of the hardware, software and communication systems (4 credits) **C4.1 –** Identifying and describing the defining elements of the performances of the hardware, software and communication systems

	C4.2 – Explaining the interaction of the factors that determine the performances of the hardware, software and communication systems **C4.3 –** Applying the fundamental methods and principles for increasing the performances of the hardware, software and communication systems **C4.4 –** Choosing the criteria and evaluation methods of the performances of the hardware, software and communication systems **C4.5 –** Developing professional solutions for hardware, software and communication systems based on performance optimization
6.2 Cross competences	N/A

7. Discipline objective (as results from the *key competences gained*)

7.1 General objective	Study and experiment with the 3D photorealistic algorithms. Development of 2D and 3D graphics applications.
7.2 Specific objectives	1. Creation of the graphic model of a 3D scene of objects 2. Implementation and usage of the fundamental 3D graphics algorithms that can be found in the core of a graphic system 3. Development of graphic applications in a high-level programming language (C, C++) based on graphics libraries (ex. OpenGL) 4. Implementation of the main phases of the graphics transformation pipeline, in order to transform a 3D scene into an image.

8. Contents

8.1 Lectures	Hours	Teaching methods	Notes
Computational graphics	2	New multimedia teaching approaches will be used in classes. The course is interactive and includes demonstrations that exemplify graphical methods and algorithms.	During the semester and before each exam there are a few preparation hours planned.
Hidden line and surface removal algorithms. Part 1	2		
Hidden line and surface removal algorithms. Part 2	2		
3D objects modeling. Polygonal models. Parametrical model. Procedural models.	2		
Particles based models	2		
Polygonal objects rendering. Part 1	2		
Polygonal objects rendering. Part 2	2		
Illumination models. Local reflection model. Phong model	2		
Shadow computation	2		
Texture mapping. Part1	2		
Texture mapping. Part2	2		
Global reflection models. Ray-tracing algorithm	2		
Global reflection models. Radiosity algorithm	2		
Graphical animation	2		

Bibliography

1. Watt A., "*3D Computer Graphics*". Addison-Wesley.
2. Watt A., Policarpo F.:"*3D Games. Real-time Rendering and Software Technology*". Addison-Wesley.
3. Shreiner D., Sellers G., Kessenich J., Licea-Kane B., "OpenGL Programming Guide", Addison-Wesley.
4. Foley J.D., van Dam, A., Feiner, S.K., Hughes, J.F., "*Computer Graphics. Principles and Practice*". Addison-Wesley Pblishing Comp.

In virtual library

Course resources, https://moodle.cs.utcluj.ro/

8.2 Applications – Seminars/Laboratory/Project	Hours	Teaching methods	Notes
Mathematics for computer graphics	2	Documentation and examples will be available to the students, prior to the laboratory classes, on a dedicated server. The students will work	Each student will have to develop a specific project based on the knowledge acquired at
Introduction to modern OpenGL	2		
Basic vertex and fragment shaders	2		
Debugging methods	2		
3D Transformations	2		
3D models and textures	2		
First project evaluation	2		

Lighting model - Part 1	2	independently but will also be assisted by the teacher.	the laboratory hours.
Lighting model - Part 2	2		
Shadow mapping	2		
Second project evaluation	2		
Cube maps and environmental mapping	2		
Normal mapping	2		
Final project assessment	2		
Bibliography 1. Curse and practical works, http://cgis.utcluj.ro/teaching/			

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

This discipline is integrated into the Computers and Information Technology domain. The content is classic, yet modern, and introduces to students the fundamentals of 3D graphic systems and algorithms. The content of this discipline has been aligned with the information presented in similar disciplines from other major universities and companies from Romania, Europe and USA and has been evaluated by the authorized Romanian governmental agencies (CNEAA and ARACIS).

10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	The written exam evaluates the understanding of the information presented in classes and the ability to apply this knowledge. The activity in class evaluates the active involvement of the students in the teaching process and their participation to the discussions, debates and other class activities during the entire semester.	Evaluation is performed through written exam and activity at the course.	50% (E) 10% (AC)
Laboratory	Laboratory assessment evaluates the practical abilities obtained by the students. Through homework assignments the students have the opportunity to develop their skill in applying the notions, concepts and methods presented in class.	Evaluation is performed through written and practical exam.	40% (L)
Minimum standard of performance: Graduation requirement: M≥5, final mark M=0.5*E+0.4*L+0.1*AC Requirement to participate to exam: L≥5			

	Teachers	Title First name Last name	Signature
Date of filling in: 29.06.2023	Course	Prof.dr.eng. Dorian Gorgan	
	Applications	Conf.dr.eng. Victor Bacu	
		Lect.dr.eng. Adrian Sabou	
		Lect.dr.eng. Constantin Nandra	

Date of approval in the department

Head of department,
Prof. dr. eng. Rodica Potolea

Date of approval in the Faculty Council	Dean, Prof. dr. eng. Liviu Miclea