



POLITECNICO
MILANO 1863

DIPARTIMENTO DI ELETTRONICA
INFORMAZIONE E BIOINGEGNERIA



2024

Dipartimento di Elettronica, Informazione e Bioingegneria
Computer Graphics

Milano, 2024



Computer Graphics

- Introduction to the course



Course structure

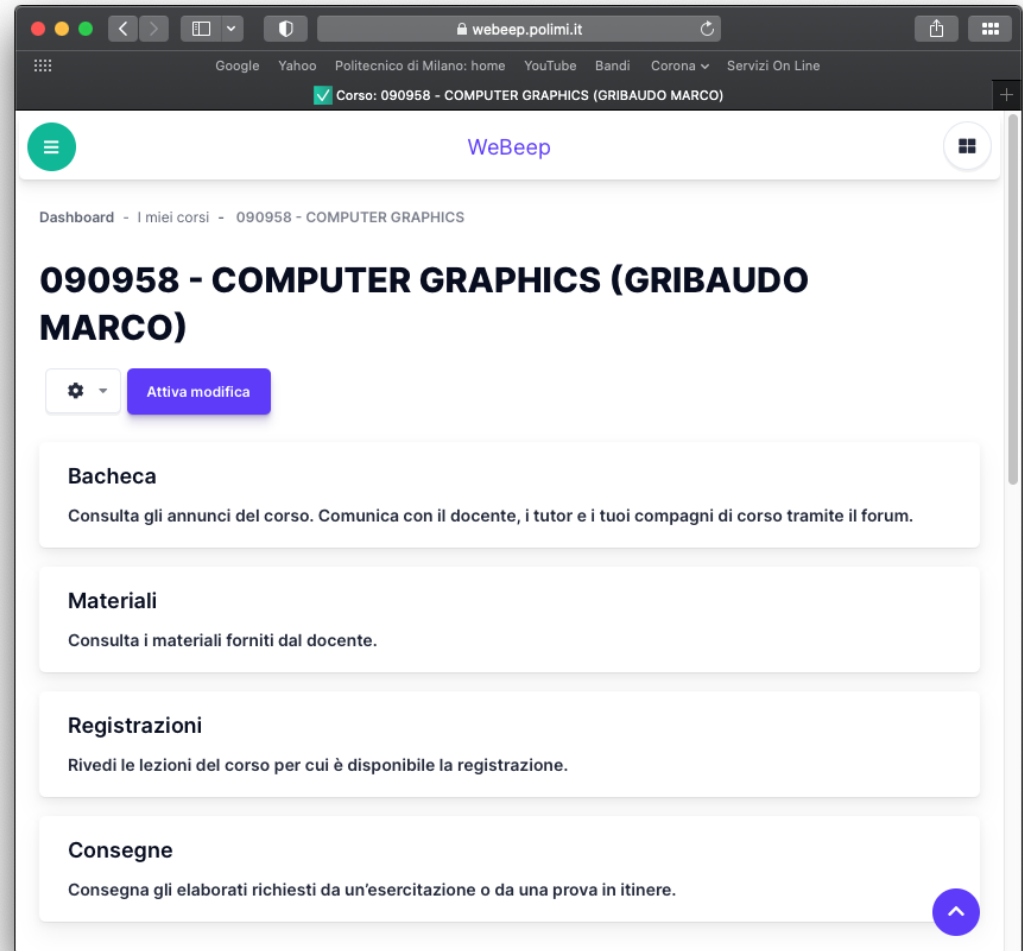
The course will be composed by 2 hours of in-person sessions, on Monday and Wednesday. Each session will mix theory, examples and applications.

It will be given by
Prof. Marco Gribaudo

Slides will be published on the WeBeep web page of the course.

Lessons will be recorded and Video will be made available as soon as possible.

Streaming will be left open for occasional use, and maintained only if that option will not be abused by too many students.



Course structure

Theory will describe the techniques, the algorithms and the main data-structures involved in Computer Graphics.

Assignments and examples will be used to show practical implementation of the proposed techniques.

The main structure of the course will be the following:

- Basic 3D graphics
- *Vulkan*
- Shaders and real-time rendering

Why Vulkan?

Vulkan is the most supported standard that allows to perform low-level graphics operations.

It is available on:

- Android, Linux, BSD Unix, QNX, Nintendo Switch, Raspberry Pi, Stadia, Fuchsia, Tizen, Windows (from version 7)
- MoltenVK provides freely-licensed third-party support for iOS and macOS based on Metal.



We will be using C++ to interface with Vulkan.

Do not worry! Although Vulkan is very complex, and C++ is not a simple programming language, we will limit our usage to the main features of both, which are relevant to the theoretical part of this course:

- We will make sure that using both technologies will not require more effort than a program written *Javascript*.
- More technical students will be able to enjoy the powerful and advanced features of both technologies.
- Less technical students will have pre-built starting points, where only “standard programming language code” should be added to obtain the desired graphics results.
- However, students are **required** to be *comfortable* with programming, regardless of their curriculum.

Hardware requirements

Although most of the platforms are supported, Vulkan requires a development environment with a suitable GPU.

Anybody having a full-fledge PC less than 10 years old should be able to work on the proposed examples and assignments.

The use of however of older or non-standard solutions (i.e. an *Arm Based Windows Surface*) could not be supported: if you do not have access to a suitable developing device, probably you will not be able to follow this course.

The *Vulkan Starter Day*

Setting up the development environment for your own specific system is probably the most difficult initial step.

Assignment one, beside giving you a simple task to learn normalized screen coordinates, has the purpose of letting you install and understand your own Vulkan development environment.

Expected outcome and Application Fields

Knowledge of the theoretical basics of Computer Graphics.

Introductory knowledge of Vulkan.

There are many application fields, some may be:

- Video Games Design
- Scientific Visualization
- Architectural Visualization

Exam

During the course several assignments will be given (about one per week). A final project will also be given near the end of the course.

The exam will be an oral discussion where the project will be presented. Some theory questions might be asked to verify the level of knowledge of the topic.

Projects topics and rules will be presented after the middle of the course, when we will have seen sufficient material to start implementing it.

Solutions to the assignments will be delivered in a single upload on a *WeBeep resource* that will be made available near the end of the course. This delivery will have to be done before the exam, with a final deadline around one year from now. We will return on these details later in the course.



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(Remember to use the phone, since mails might require a lot of time to be answered. Microsoft Teams messages might also be faster than regular mails)