ACADEMIC PROGRAM

LOW-LEVEL PROGRAMMING

B.F.A. IN **COMPUTER SCIENCE**

MODALITY: ON CAMPUS

ACADEMIC YEAR: 2022-2023

Name of the course:	Low-level programming
Degree :	Computer Science
Location:	Centro Universitario de Tecnología y Arte Digital
Area:	Optativity
Year:	4º
Teaching period:	2
Type:	OP
ECTS credits:	3
Teaching modality:	On campus
Language:	English
Lecturer / Email	-
Web page:	http://www.u-tad.com/

SUBJECT DESCRIPTION

Area description

This subject includes some advanced and/or specialized content that a generalist software engineer may require.

Subject description

This subject is relevant to acquire knowledge of programming oriented to specific hardware, highlighting the importance of code efficiency, direct memory access and resource management

COMPETENCIES AND LEARNING OUTCOMES

Competencies

BASIC AND GENERAL SKILLS

CG1 -Ability to understand, schedule and solve problems trough software development

CG2 - To develop software that are environmental friendly, engaged with society and natural resources and law and ethics compliant

CG3 - Knowledge of the scientific fundamentals applicable to the resolution of computer problems

CG4 - Ability to simplify and optimize computer systems by understanding their complexity

CG6 - Develop collaborative projects showing teamwork skills, versatility, flexibility, creativityand respect for the work of the team members

CG7 - Knowledge of the creative foundations of ideation in software development projects.

CG9 - Ability to learn, modify and develop new software solutions

CG10 - Use of creative techniques to carry out computer projects

CG11 -Ability to search, analyze and manage information for insights capture

BC1: Students should demonstrate knowledge in an area of study that builds upon the foundation of general secondary education and goest beyond at a level that, while supported by advanced textbooks, also encompasses certain aspects derived from the cutting edge of their field of study.

BC2: Students should be able to apply their knowledge to their work or vocation in a professional manner, and they should possess the competencies typically demonstrated through the development and defence of arguments as well as problem-solving within their field of study.

BC3: Students must possess the ability to gather and interpret relevant data (usually within their field of study) in order to make judgments that involve reflection on socially, scientifically, or ethically significant issues.

BC4: Students should be capable of conveying information, ideas, problems, and solutions to both specialized and non-specialized audiences.

BC5: Students should have developed the learning skills necessary to pursue further studies with a high degree of autonomy.

TRANVERSALES SKILLS

CT1 - Knowledge of the definition, scope and implementation of the fundamentals of project management methodologies for technology projects

CT2 - Knowledge of the main sectorial players and the life cycle of a digital content development and commercialization project

CT4 - Ability to update the knowledge acquired in the management of digital tools and technologies according to the current state of affairs of the sector and the technological solution

CT5 - Development of the basic skills for digital entrepreneurship.

SPECIFIC SKILLS

CE10 - Ability to work with a release manager and generate application documentation automatically.

CE15 - Knowledge of fault tolerance, adaptability, load balancing and system predictability for distributed application development

CE17 - Knowledge of the parallelization characteristics of graphics cards and high-performance architectures for application development.

CE20 - Ability to test the operation and functionality of a computer application, develop test plans and use test-oriented design and programming techniques

CE21 -Ability to assess the quality of a computer application by applying software quality measurement metrics, procedures, and standards

Learning outcomes

Upon completion of the degree, the graduate will be able to:

- To understand the software quality assurance cycle

- To design a testing plan

- To know the most common testing frameworks in industry

- To develop an intensive-GPU application

- To be able to profile a distributed application

CONTENTS

GPU programming

Distributed systems profiling

SUBJECT SYLLABUS

Topic 1: Introduction to low-level languages

• C/C++ review

• Review of HW architectures

Topic 2A: Use of "binary" files

• Reading library implementation for a given format

Topic 2B: Vector instruction sets

• Use of vector instruction sets for X86_64: AVX/SSE

Topic 3: Coprocessors

• Introduction to parallelism

• Use of GPUs as coprocessor: NVidia CUDA

Topic 4: System calls and memory management

• Implementation of a malloc type memory manager

TRAINING ACTIVITIES AND TEACHING METHODOLOGIES

TRAINING ACTIVITIES

LEARNING ACTIVITIES	Total hours	Hours of presence

Theoretical / Expository classes	16,00	16,00
Practical classes	11,00	11,00
Tutorials	2,00	1,00
Independent study and autonomous work of the student	25,00	0,00
Elaboration of work (group or individual)	18,00	0,00
Evaluation Activities	3,00	3,00
TOTAL	75	31

Teaching methodologies

Expository method or master lesson

Case learning

Learning based on problem solving

Cooperative or collaborative learning

inquiry learning

Flipped classroom methodology

Gamification

Just in time Teaching (JITT) or classroom on time

Expository method or master lesson

Case method

Learning based on problem solving

Cooperative or collaborative learning

inquiry learning

Flipped classroom methodology

Gamification

TEMPORAL DEVELOPMENT

DIDACTIC UNITS / TOPICS TIME PERIOD

Topic 1: Introduction to low-level languages

1 weeks

Topic 2A: Use of "binary" files

2 weeks

Topic 2B: Vector instruction sets

2 weeks

Topic 3: Coprocessors

3 weeks

Topic 4: System calls and memory management

2 weeks

EVALUATION SYSTEM

ASSESSMENT SYSTEM	MINIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)	MAXIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)
Assessment of participation in class, exercises or projects of the course	10	30
Assessment of assignments, projects, reports, memos	30	60
Objective test	30	60

GRADING CRITERIA

ASSESSMENT SYSTEM	ORDINARY EVALUATION	EXTRAORDINARY EVALUATION
Assessment of participation in class, exercises or projects of the course	10	10
Assessment of assignments, projects, reports, memos	60	60
Objective test	30	30

General comments on the evaluations/assessments

• The evaluation of participation in class, in practices or in projects of the subject will be carried out based on attendance and active participation in class and in the rest of the activities developed during the course. That will include delivering required assignments on time. This aspect will represent 10% of the final grade for the subject in the ordinary call.

• Throughout the course, activities, exercises and problems will be proposed that must be delivered before the indicated date through the virtual platform. This work will be evaluated through the virtual platform itself and will account for 60% of the final grade for the subject in the ordinary call. Work out of form and date will not be accepted without justified cause. In the event that the grade for an exercise does not reach the pass mark, a new delivery will be admitted, which if it is of sufficient quality will have a grade of 5.0.

• To pass the subject in the ordinary call, it is essential that the final grade is at least 5.0 (out of 10). In addition to this requirement, it is necessary that the average of the proposed assignments is at least 5.0 (out of 10), and that the final exam grade is at least 5.0 (out of 10). If any of these requirements are not met, the subject will be automatically considered failed regardless of the rest of the grades.

• If the student does not pass the ordinary session, he or she may take the extraordinary session. A final exam will be taken that will represent 30% of your grade in said call, and in which all the content of the subject seen in class will be part of the subject required of the student. The other 60% will be calculated from the deliverable practical exercises requested throughout the subject. Finally, 10% of the participation obtained during the first call will be maintained. To pass the subject in the extraordinary call, it is essential that the final grade is at least 5.0 (out of 10). In addition to this requirement, it is necessary that the average of the proposed assignments is at least 5.0 (out of 10), and that the final exam grade is at least 5.0 (out of 10).

• In an extraordinary call, a note of everything delivered so far will be kept.

• If you have suspended or have not delivered practices on the requested dates, a new delivery will be requested, solving errors. These deliveries will have at least a penalty of 10% of the maximum grade, which will not affect the minimum required for passing (5). That means they will have a maximum grade of 9 out of 10.

• The use of notes or programmable scientific calculators is not allowed in the exams, for which the student must refer to the teacher's specific instructions on this topic.

• All code and work submitted by students must be ORIGINAL. This means that they must have been developed by the students throughout the course, without external help. If code/libraries external to what is provided by the teacher are used, it must be duly documented and justified. It is allowed to consult documentation external to the subject, but the code delivered by the student must respect current copyright laws and software licenses. In any case, the student must be able to explain the code used and delivered during the course.

• Copies between works: A working copy will be understood as those projects that contain equal or very similar parts, that do not comply with the rules established in the previous paragraphs. Copies of work will lead to complete suspension of the subject, with no possibility of recovery in the current call. It will be the teacher who decides the seriousness of the copy, and the final decision may be consulted and revoked by the rest of the teaching team if a second opinion is needed.

• No grades of any kind will be kept between different academic courses, only between ordinary and extraordinary calls for the same course.

• The use of mobile phones in the classroom is not allowed during the continuous evaluation period, unless expressly indicated otherwise by the teacher. Laptops may only be used for activities related to the subject. The teacher may withdraw the right to use the computer from those students who use it for activities that are not related to the subject (checking emails, news or social networks, consulting or preparing activities for other subjects, etc.).

• It is not allowed to consume drinks or food in the classroom. The presence of any type of drink on the tables is also not permitted, even in closed containers.

• Active participation will be required from the student, necessary for the development of the classes.

• The student will be required to behave well at all times during the classes. Bad behavior that prevents the normal development of the class may lead to expulsion from the classroom for a period of time to be determined by the teacher.

LIST OF REFERENCES (BOOKS, PUBLICATIONS, WEBSITES):

Basic Bibliography:

• ADDISON WESLEY Ed 1(2010); CUDA by Example

Recommended Bibliography:

• PRENTICE HALL Ed. 0006 (2010) Assembly Language for X86

REQUIRED MATERIALS, SOFTWARE AND TOOLS

Type of classroom
Theory classroom

Board and projection system

Materials:
Computers with Linux operating system and NVidia GTX400 series graphics cards or higher.

Virtual machines are not valid, it is necessary a "native" Linux to be able to perform all the practices.

Software:
Sistema Operativo Linux