Universidad de Navarra

Computer Programming

Teaching guide 2026-27

PRESENTATION

Brief description:

Engineers design, develop, test and deploy heterogeneous software applications and systems throughout their lives, and in many cases these systems will contain a significant software load. Since these software applications will have different functions, it is essential to understand the principles of their operation. This subject is the students' first contact with programming and computer languages, and also provides them with their basic theoretical and practical concepts.

At the end of this course, the student should be able to:

- Have gained an introductory insight into the field of computer programming.
- Focus on problem solving through algorithm design.
- Make efficient use of data and control structures in order to implement algorithms and provide answers to the problems posed.
- Interpret the operation of a programme without being required to run it.
- Study basic search and sorting algorithms.

Qualification (Module/Subject):

- Industrial Technologies Engineering (Basic Training/ Computer Science)
- Mechanical Engineering (Basic Training/ Computer Science)
- Electrical Engineering (Basic Training/ Computer Science)
- Industrial Electronics Engineering (Basic Training/ Computer Science)
- Telecommunication Systems Engineering (Basic Training/Computer Science)
- Industrial Management Engineering (Basic Training/ Computer Science)
- Industrial Design and Product Development Engineering (Basic Training/ Computer Science)
- Biomedical Engineering (Basic Training/ Computer Science)
- Artificial Intelligence Engineering (Basic Training/Computer Science)

Details:

- **ECTS**: 6 ECTS
- **Year, semester:** 1st year, 1st semester
- **Character**: Basic
- **Language**: English

Lecturers in the subject:

- Csiszar, Gábor / Profesor visitante
- Puime Pedra, Matheus / Profesor

COMPETENCES / LEARNING OUTCOMES

INDUSTRIAL TECHNOLOGIES ENGINEERING

R1 – Students will have demonstrated possession and understanding of knowledge in a field of study that builds on general secondary education, and is typically found at a level which, while supported by advanced textbooks, also includes aspects that involve knowledge drawn from the forefront of their field of study.

R4 – Basic knowledge of the use and programming of computers, operating systems, databases, and software applications with relevance in engineering.

MECHANICAL ENGINEERING

R1 – Students will have demonstrated possession and understanding of knowledge in a field of study that builds on general secondary education, and is typically found at a level which, while supported by advanced textbooks, also includes aspects that involve knowledge drawn from the forefront of their field of study.

R24 – Knowledge in basic and technological subjects that enables them to learn new methods and theories, and provides them with versatility to adapt to new situations.

R4 – Basic knowledge of the use and programming of computers, operating systems, databases, and software applications with relevance in engineering.

ELECTRICAL ENGINEERING

R1 – Students will have demonstrated possession and understanding of knowledge in a field of study that builds on general secondary education, and is typically found at a level which, while supported by advanced textbooks, also includes aspects that involve knowledge drawn from the forefront of their field of study.

R2 – Knowledge in basic and technological subjects that enables them to learn new methods and theories, and provides them with versatility to adapt to new situations.

R5 – Basic knowledge of the use and programming of computers, operating systems, databases, and software applications with relevance in engineering.

INDUSTRIAL ELECTRONICS ENGINEERING

R1 – Students will have demonstrated possession and understanding of knowledge in a field of study that builds on general secondary education, and is typically found at a level which, while supported by advanced textbooks, also includes aspects that involve knowledge drawn from the forefront of their field of study.

R22 – Knowledge in basic and technological subjects that enables them to learn new methods and theories, and provides them with versatility to adapt to new situations.

R4 – Basic knowledge of the use and programming of computers, operating systems, databases, and software applications with relevance in engineering.

TELECOMMUNICATION SYSTEMS ENGINEERING

R1 – Students will have demonstrated possession and understanding of knowledge in a field of study that builds on general secondary education, and is typically found at a level which, while supported by advanced textbooks, also includes aspects that involve knowledge drawn from the forefront of their field of study. *(Type: Knowledge or Content)*

R3 – Basic knowledge of the use and programming of computers, operating systems, databases, and software applications with relevance in engineering. *(Type: Knowledge or Content)*

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INDUSTRIAL ORGANISATION ENGINEERING

R1 – Students will have demonstrated possession and understanding of knowledge in a field of study that builds on general secondary education, and is typically found at a level which, while supported by advanced textbooks, also includes aspects that involve knowledge drawn from the forefront of their field of study.

R4 – Basic knowledge of the use and programming of computers, operating systems, databases, and software applications with relevance in engineering.

R40 – Provide solid foundations in science, technology, operations management, production, and business management.

INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING

R5 – Basic knowledge of the use and programming of computers, operating systems, databases, and software applications with relevance in engineering.

BIOMEDICAL ENGINEERING

R1 – Students will have demonstrated possession and understanding of knowledge in a field of study that builds on general secondary education, and is typically found at a level which, while supported by advanced textbooks, also includes aspects that involve knowledge drawn from the forefront of their field of study.

R31 – Training should provide graduates with a solid scientific foundation that allows them to rigorously address the professional challenges of the biomedical sector.

R24 – Basic knowledge of the use and programming of computers, operating systems, databases, and software applications with relevance in engineering.

ARTIFICIAL INTELLIGENCE ENGINEERING

R17 – Solve problems requiring simple algorithms, from their design to implementation, testing, and debugging. *(Type: Competencies)*

R29 – Efficient use of the most appropriate data types and data structures for problem-solving. *(Type: Skills or Abilities)*

R30 – Write code in accordance with certain good practice standards, and if complex, divide it into logical parts that can be solved (programmed) independently. *(Type: Skills or Abilities)*

COURSE CONTENT

Unit 1: Introduction to computers

- Structure and basic operation of the elements of a computer. Numbering systems and logical operations.

- Basic structure and operation of the software that controls a computer: operating systems, applications and libraries.

- Databases.

- Programme definition and types of existing programming languages.

Unit 2: Introduction to Matlab

- Definition of variables, vectors and matrices. Basic mathematical operations in Matlab.

- Operations with matrices, polynomials, vectors, derivatives, integrals.

- Matlab working environment: command window, workspace, programming in files, etc.

Unit 3: Control Structures I

- Control structures: conditions and loops.

- Use of the debugger.

Unit 4: Control Structures II

- More complex control structures with nested loops.

- Use of the debugger.

Unit 5: Graphics

- 2D and 3D drawing functions (plot and surf).

- Inline function

- Animations

Unit 6: Functions

- Definition of functions in own files.

- Parameter passing and calls to these functions.

Unit 7: Image processing

- Functions for image processing in Matlab.

Unit 8: Sorting methods

- Analysis of different management methods and their efficiency

Unit 9: Advanced data structures

- Advanced data structures (structs, strings)

- Performance instructions (tick, tick) and profiler

Unit 10: Graphical user interface design - GUIs

- Event-oriented programming

- Graphical user interface: GUI

Unit 11: File management

- Read and write to text files (fopen, fseek, fclose)

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Unit 12: Databases

- Types of database, SQL

TRAINING ACTIVITIES

The **150-160 hours** (6 ECTS) **set aside** for the Computer Science course are divided into the following training activities:

- Theoretical face-to-face classes: 20 hours
- Face-to-face practical classes, laboratories and workshops: 40 hours
- Supervised work: 20 hours
- Personal study: 80 hours
- Tutorials: 5 hours
- Evaluated tests: 10 hours

EVALUATION

Ordinary examination session

1 – Continuous Assessment (CA) of activities throughout the course

Throughout the course, tests and problem submissions will be carried out to monitor students' progress.

IMPORTANT: These activities will not be repeated outside regular class hours.

2 – First Midterm Exam (M1)

The student will take an exam to put into practice the concepts covered in class. This exam will focus on the use of variables, conditions, and loops.

Date: Saturday, September 27

3 – Second Midterm Exam (M2)

The student will take a Matlab exam to put into practice the concepts covered in class.

Date: Saturday, November 8

4 – Final Exam (FE)

All students must take a **compulsory final exam**.

Date: December 9, in the morning.

Criteria for evaluating the course in the ordinary call:

Several evaluation methods are proposed, and the final grade will be the best of the following options:

- **Option 1:**

- **FinalGrade = 15% CONTINUOUS ASSESSMENT (CA) + 10% MIDTERM EXAM 1 (M1) + 60% MIDTERM EXAM 2 (M2) + 15% FINAL EXAM (FE)**
- The final exam (FE) will cover a reduced amount of content.
- To be assessed under this option, a minimum grade must be obtained in each of the two midterms as follows:
  - Grade M1 ≥ 5 AND Grade M2 ≥ 5.5
- All students who pass M1, M2, and FE will have their exam grades multiplied by 1.1.
- It will be necessary to take the final exam (FE) in order to pass the course, even if the weighted average of M1, M2, and continuous assessment (CA) is already 5 or higher. Additionally, **students must obtain a minimum grade of 3.5 out of 10 in the final exam (FE).**

- **Option 2:**
  - **FinalGrade = 15% CONTINUOUS ASSESSMENT (CA) + 70% MIDTERM EXAM 2 (M2) + 15% FINAL EXAM (FE)**
  - The final exam (FE) will cover a reduced amount of content.
  - To be assessed under this option, a minimum grade of 6 in M2 is required.
  - All students who pass M1, M2, and FE will have their exam grades multiplied by 1.1.
  - It will be necessary to take the final exam (FE) in order to pass the course, even if the weighted average of M2 and continuous assessment (CA) is already 5 or higher. Additionally, **students must obtain a minimum grade of 3.5 out of 10 in the final exam (FE).**
- **Option 3:**
  - **FinalGrade = 15% CONTINUOUS ASSESSMENT (CA) + 85% FINAL EXAM (FE)**
  - The final exam (FE) will cover the entire syllabus of the course.

Academic integrity clause:

Any case of plagiarism or cheating in any of the activities carried out during the course and /or in the exams will result in a **Fail** grade in the ordinary call.

Extraordinary examination session

For this examination session, **grades obtained through Continuous Assessment (CA) or midterm exams (M1 or M2) will not be retained**. The exam will be graded out of 10 points, and **a minimum score of 5 will be required to pass**.

Under no circumstances will the additional points obtained through course activities be carried over to the following academic year.

The extraordinary examination will take place on **January 12**.

Any instance of plagiarism or cheating will result in a **Fail** grade in the extraordinary session.

Change of examination dates

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Requests to change exam dates must be made via a general request, indicating the subjects and reasons for which the change is requested.

https://tecnun.unav.edu/conoce-la-escuela/calidad#normativa

Changes in examination dates will only be granted in the event of:

- Serious illness requiring hospitalisation on the examination date.
- A serious family situation.
- If students are representing the University in an institutional activity (official sports competitions or university congresses).
- When the Tecnun exam coincides in date and time.

OFFICE HOURS

Lecturers will be available to answer any queries about the subject according to the following timetable:

Thursdays from 14.30h to 16h in classroom 2.

Questions outside this period must be posted on the course forum.

Prof. Matheus Pedra (mpuime@unav.es)

BIBLIOGRAPHY and RESOURCES

Online resources

The following resources can be very useful for students to work on their own thanks to the Matlab online courses:

MATLAB FUNDAMENTALS:

https://matlabacademy.mathworks.com/R2020a/portal.html?course=mlbe

MATLAB ON-RAMP:

https://matlabacademy.mathworks.com/R2020a/es/portal.html?course=gettingstarted

Basic bibliography (available at ESI)

1. Aguinaga I., Martinez, G. and Díaz J., Aprenda a programar como si estuviera en primero, TECNUN. Download

2. García de Jalón J., Atencia J. and Nestar R., Aprenda Matlab 6.0 como si estuviera en primero, TECNUN. Download

3. Castrillón, M., Domínguez, A., Candela, S., Fundamentos de Informática y Programación para Ingeniería, Paraninfo, 2011. Find it in the library