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:

- Gain an introductory understanding of the field of computer programming.
- Approach problem-solving through algorithm design.
- Efficiently use of data and control structures to implement algorithms and address the problems posed.
- Interpret the operation of a program without needing to execute 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 Organization 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**: Core/Basic
- **Language**: English

Lecturers in the subject:

- 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.

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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)*

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.

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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 Computer Programming & MATLAB

- Computer fundamentals: structure and basic operation of hardware and software (operating systems, applications and libraries). Numbering systems and logical operations

- Definition of a program and types of programming languages.

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

- MATLAB basics: variables, vectors, and matrices. Basic mathematical operations, including matrices, polynomials, vectors, derivatives, and integrals.

Unit 2: Control Structures I

- Variable types and assignment in MATLAB.

- Conditional structures (if, elseif, else) using relational and logical operators.

- For loops: syntax, iteration over vectors and ranges, loop indices.

- Use of the debugger.

Unit 3: Control Structures II

- While loops: syntax and use cases, exit conditions.

- Switch-case structure as an alternative to multiple conditionals.

- Break and continue statements.

Unit 4: Control Structures III

- Complex control structures with nested loops.

- Use of the debugger.

Unit 5: Graphics and Sorting Methods

- 2D and 3D drawing functions (plot, plot3, figure, axis, title, etc).

- Inline function.

- Animations.

- Analysis of different sorting methods and their efficiency.

Unit 6: Functions

- Definition of functions in separate files.

- Passing parameters and calling these functions.

Unit 7: Images

- Functions for handling images in MATLAB.

Unit 8: Advanced data structures

- Advanced data structures (structs, character strings).

- Performance-related commands (tic, toc) and the profiler.

Unit 9: File management

- Reading from and writing to text files (fopen, fseek, fclose).

Unit 10: Design of GUIs

- Event-driven programming.

- Graphical user interface (GUI).

Unit 11: Databases

- Types of database, SQL.

TRAINING ACTIVITIES

The **150-160 hours of workload** (6 ECTS) for this Computer Programming course are distributed across the following learning activities:

- In-person lectures: 20 hours
- In-person practical classes/labs: 40 hours
- Supervised assignments: 20 hours
- Independent study: 80 hours
- Office hours/tutorials: 5 hours
- Assessment: 10 hours

ASSESSMENT

NOTICE: Please note that any attempt at fraud, cheating, plagiarism, or other irregular conduct constitutes a serious offense, as set out in Title IV, "Rules of Academic Discipline for Students," within the University of Navarra's Code of Conduct.

Ordinary examination session

1 – Continuous Assessment (CA) of activities throughout the course: 15% of the grade

Test and problems sets will be administrated throughout the course to monitor student progress.

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

2 – Midterm Exam (ME)

The student will take an exam to apply the concepts covered in class.

Date: Saturday, October 17

3 – Final Exam (FE)

All students are required to take a **mandatory final exam**.

Date: December 10, in the morning.

Criteria for evaluating the course in the ordinary call:

Two different grading methods are available, and the final frade will be the best result among the following options:

- **Option 1:**
  - **FinalGrade = 15% CONTINUOUS ASSESSMENT (CA) + 25% MIDTERM EXAM (ME) + 60% FINAL EXAM (FE)**
  - The final exam (FE) will cover a reduced amount of content.
  - To be eligible for this option, students **must obtain a grade of # 5 on the midterm exam (ME).**
  - Students must take the final exam (FE) to pass the course, and **must obtain a minimum grade of 3.5 out of 10 on the final exam (FE).**
  - All students who obtain a grade of #5 on the ME and #5 on the FE will have their exam grades multiplied by 1.1.
- **Option 2:**
  - **FinalGrade = 15% CONTINUOUS ASSESSMENT (CA) + 85% FINAL EXAM (FE)**
  - The final exam (FE) will cover the entire syllabus of the course.

Extraordinary examination session

For this examination session, **grades obtained through Continuous Assessment (CA) or midterm exam (ME) 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 any additional points earned through activities completed during the course be carried over to the following academic year.

The extraordinary examination will take place on **January 15**.

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 4.

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