

<i>Course</i>	<b>Mechanical and Industrial Informatics</b>			<i>Academic year</i>	2021/2022	
<i>Subject</i>	<b>Technology and CNC Programming</b>			ECTS	6	
<i>Type of course</i>	<b>Compulsory</b>					
<i>Year</i>	<b>2nd</b>	<i>Semester</i>	<b>2nd</b>	<i>Student Workload:</i>		
<i>Professor(s)</i>	<b>Arlindo Augusto Marques Ferreira</b>			<i>Total</i>	162	<i>Contact</i> 60
<i>Area Coordinator</i>	<b>José Reinas dos Santos André</b>					

**Planned SD**

## 1. LEARNING OBJECTIVES

At the end of the curricular unit the students approved should have the ability to:

- Know the importance and frame CNC Technology in the production system, particularly in the Metalomechanic Industry;
- Identify and describe CNC equipment, its working principles and features;
- Know the interfaces and protocols of computer - machine communication;
- Know the main controllers used in CNC programming;
- Identify the coordination systems, axes and work plans and reference points in CNC programming and machining;
- Know the structure of a CNC program;
- Identify the main ISO codes (G and M) of a CNC program;
- Interpret any instruction block of a CNC program;
- Program in ISO code and program commercial CNC controllers;
- Elaborate, optimize, simulate, validate and execute CNC machining programs in milling and turning operations.

## 2. PROGRAMME

- 1 Introduction to CNC Technology and Programming
  - 1.1 Comparison between CNC technology, conventional technologies and emerging technologies. Industrial applications of CNC technology.
  - 1.2 Types of CNC equipment; milling machines, lathes and machining centers. Identification and Characterization.
  - 1.3 CNC communication protocols and software.
  - 1.4 CNC equipment remote control.
- 2 Coordination systems, axes and work plans
  - 2.1 The coordinate system in the cartesian plane.
  - 2.2 The working axes of CNC equipment.
  - 2.3 Work Plans.
  - 2.4 Reference points in CNC programming and machining.
  - 2.5 Absolute and incremental work coordinates.
- 3 CNC programming
  - 3.1 Structure of a CNC program.
- 4 Milling and turning programming

- 4.1 Preparation of CNC programs for machining parts.
- 4.2 Optimization, simulation, validation and execution of CNC programs.

### **3. COHERENCE BETWEEN PROGRAMME AND OBJECTIVES**

Know the importance and frame CNC Technology in the production system, particularly in the Metalworking Industry-according 1.1 of the syllabus.

Identify and describe CNC equipment, its working principles and features-according 1.2.

Know the interfaces and communication protocols -according 1.3, 1.4.

Know the main controllers used in CNC programming-according 3.1.

Identify the coordination systems, axes and work plans and reference points in CNC programming and machining-according 2.1, 2.2, 2.3; 2.4.

Know the structure of a CNC program-according 3.2; 3.3; 3.4

Identify the main ISO codes (G and M) of a CNC program-according 3.1; 4.1.

Interpret any block or set of blocks in a CNC program-according 3.1; 4.1.

Program in ISO code and program commercial CNC controllers-according 3.1; 4.1

Elaborate, optimize, simulate, validate and execute CNC machining programs in milling and turning operations-according 4.2 of the syllabus.

### **4. MAIN BIBLIOGRAPHY**

- Relvas C., "Controlo Numérico Computorizado Conceitos fundamentais", 4ª Edição, Publindústria, 2018. ISBN: 9789898927163
- Fitzpatrick, M., "Machining and CNC Technology" 4th Edition, Kindle Edition, 2018. ISBN-13: 978-1259827440; ISBN-10: 1259827445
- Rocha. J., "Programação de CNC para torno e fresadora", 1ª ed. Lisboa: FCA - Editora Informática, 2016. ISBN: 978-972-722-843-0
- Overby, A., "CNC Machining Handbook: Building, Programming, and Implementation", McGraw-Hill Education – Europe, 2010. ISBN: 9780071623018
- Silva, S. D., "CNC: programação de comandos numéricos computadorizados: torneamento", 6.ª ed. São Paulo: Érica, 2007. ISBN – 9788571948945308
- Fundamentals of CNC Machining, A Practical Guide for Beginners, Autodesk CAM, 2014. ISBN-13: 978-0-615-50059-1; ISBN-10: 0615500595
- Hans B. Kief, T. Frederick Waters, "Computer Numerical Control", Glencoe/McGraw-Hill, 1992. ISBN: ISBN-13: 9780026764117
- Thyer, G. E., "Computer Numerical Control of Machine Tools", 2nd Edition, Butterworth-Heinemann, 1991, ISBN-13: 9780750601191; ISBN-10: 0750601191

## **5. TEACHING METHODOLOGIES (INCLUDING EVALUATION)**

Teaching methodologies

Theoretical-practical classes: Oral presentation of syllabus contents using PowerPoint slide projection and solving applied exercises.

Practical classes: laboratory / workshop practice.

Requirements for passing the curricular unit:

Evaluation by a test (written test and practical work): grades equal to or higher than 10 out of 20.

Final Evaluation- exam (written test): grades equal to or higher than 10 out of 20.

## **6. COHERENCE BETWEEN TEACHING METHODOLOGIES AND OBJECTIVES**

This curricular unit aims to study the technology and CNC programming, tools used in computer numerical control equipment, a subject of great importance in the field of manufacturing technologies in metalworking industry.

Thus, the defined syllabus is supported by a theoretical-practical exposition, analysis, discussion and sharing of practical experiences and resolution of practical exercises in order to stimulate students to acquire the necessary knowledge and experience and develop the ability to analysis and decision-making, with the purpose of carrying out all necessary actions leading to the elaboration, optimization, simulation and execution of CNC programs.

## **7. ATTENDANCE**

*N.A.*

## **8. CONTACTS AND OFFICE HOURS**

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Date: 30/06/2021