

## Course Unit: **CourseCodes** – Refrigeration technology

Year 2 Semester 4 ISCED Code: 713 ECTS: 5

Type of Course Unit: Compulsory Delivery Mode: Face-to-face Language of Instruction: Portuguese

COURSE COORDINATOR: João Jorge Mestre Dias

### HOURS OF WORK

TOTAL HOURS	Contact Hours								Hours in autonomous work
	Theory	Theory and practice	Practical and laboratory work	Field work	Seminar	Internship	Tutorial guidance	Other	
125		60							65

Prerequisites (if applicable): Not applicable

### LEARNING OUTCOMES (knowledge, skills and competence)

The aim of this subject is to study the equipment used in a refrigeration system, as well as the identification of heat loads, with the purpose to resolve practical cases of dimensioning refrigeration facilities.

### CONTENTS

1. Processes with Ideal Gases; 2. Saturated and superheated steam. Saturation temperature. Subcooled liquid. Effect of pressure over saturation temperature. Vaporization. Cooling effect of vaporization. Liquid-vapor mixture. Sublimation. Condensation. Critical point. Properties of gases and vapors. 3. Psychrometric properties of air. Composition of air. 4. Psychrometric charts. Psychrometric processes: mixtures of air. Sensible heat. Sensible cooling. Refrigeration and dehumidification (theoretical and practical approach); 5. Refrigeration and vapour compression refrigeration cycle. Sensible refrigeration. Refrigeration by vaporization. Condensation equipment. Hermetic compressor-condensator units; 6. p-h charts. Theoretical cycle and real cycle; 7. Heat loads: surfaces, external air, products, respiration.

### DEMONSTRATION OF THE CONTENTS COHERENCE WITH THE COURSE UNIT'S LEARNING OUTCOMES

The classes of this course consist of two blocks of subjects: theoretical and practical classes. These different types of classes are connected. While the theoretical lectures are exposed concepts and the fundamental principles of energy, processes with ideal gases, properties of saturated vapour, vapour compression cycle, in the practical classes the students will resolve practical exercises for application of theoretical knowledgments, including the presentation of a real system for refrigeration in food industry.

### TEACHING METHODOLOGIES

The teaching methodologies are expositive lectures of the theoretical issues, practical classes for the resolution of exercises and autonomous work for collecting information for the practical report.

### DEMONSTRATION OF THE COHERENCE BETWEEN THE TEACHING METHODOLOGIES AND THE LEARNING OUTCOMES

The methodology followed is aimed to transmit to the students the fundamental concepts for understanding the whole issues included in the lecture. A special approach is undertaken in the resolution of practical exercises within each chapter. At the same time, the students will apply the knowledge in the realization of the practical report developed in a food industry. In this report, the students should identify a food industry or commercial facility and should identify the existing heat loads to calculate the power of the refrigeration system.

### EVALUATION METHODS

The final result is evaluated in the final exam (or two tests) and in the classification obtained in the practical report, in which

students have access after a successful participation at 75% of theoretical and practical lessons.

## **MAIN BIBLIOGRAPHY**

Shapiro, H.; Moran, M. (1998). Fundamental of Engineering Thermodynamics. Ed. John Wiley & Sons LTD.

Wang, S. (2001). Handbook of air conditioning and refrigeration. 2<sup>nd</sup> Edition. McGraw-Hill

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