COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Naval Architecture		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	NAOME1247	**SEMESTER**	7th
COURSE TITLE	**REFRIGERATION – AIR CONDITIONING**		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS (ECTS)**
Lectures		4	4
COURSE TYPE *general background, specialbackground, specialized general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	NAOME1217 - Thermodynamics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/NA208/		

(2) COURSE GOALS / LEARNING OUTCOMES

The aim of the course is to understand the principles of thermal comfort air conditioning, as well as the need for industrial refrigeration and to be able to design the required relevant systems. After the completion of the course, the student should:

- Know the basic characteristics of the refrigeration and air conditioning systems in small scale applications and industrial plants.
- Perform calculations of heat losses and cooling loads in a closed space.
- Demonstrate in simple case studies the calculation and design of a ventilation and air conditioning system, as well as the related refrigeration plant.
- Be aware of energy conservation technologies and environmental laws concerning CO2 reduction, in order to design mechanical engineering plants with ecological conscience.

(3) COURSE CONTENT / SYLLABUS

Lectures:

- Introduction, definition, thermal comfort air conditioning, industrial refrigeration, applications in Marine Engineering, kinds of cooling machines, thermodynamics of cooling cycles, inverse Rankine and Brayton cycles. Trigeneration plants.
- Theoretical and real cooling vapor compression cycles, compressor isentropic efficiency, superheating of refrigerant vapor, subcooling of refrigerant condensate. Calculation and improvement of coefficient of performance (COP). Two-stage and multi-stage refrigeration systems. Heat pump and its operation in heating and cooling modes. Elements of

refrigeration plants: compressors (various types), condensers (air-cooled, water-cooled) evaporators, expansion valves, control and safety systems. Performance calculations in refrigeration plants. Vapor absorption refrigeration plants (H2O/LiBr and NH3/H2O). Environmental impact of refrigerants, Ozone Depletion Potential (ODP), Global Warming Potential (GWP). Reference to liquefaction cycles (high-low pressure), cryogenic gases.

- Psychrometry, psychrometric chart, psychrometric processes, sensible and latentloads, the air conditioning problem. Thermal comfort, required ventilation, selection of indoor and outdoor design conditions, kinds of cooling loads, thermal inertia, time lag phenomena. Calculation of heating and cooling loads.
- Overview of an air conditioning system. Mechanical installations. Classification of air conditioning systems. Calculation of air conditioning systems on the psychrometric chart. Design of air conditioning system in case studies. Calculation of cooling coil, hydraulic network, duct sizing and pump selection. Mechanical ventilation, calculation of air ducts, fans and air diffusers. Air-to-air heat exchangers. Part-load operation, energy consumption estimation. Reference to control and energy conservation systems in air conditioning plants.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	• Support learning through the electronic e-class platform.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS*	

Activity	*Workload (hours)*
Lectures	44
Laboratory demonstration	8
Homework assignments	30
Individual study	35
Course total	***117***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other*	Evaluation: Alternatively, percentage of the final mark could be obtained by means of an assignment or project presentation.

(5) ATTACHED BIBLIOGRAPHY

- McQuiston C. F, Parker D. J., Heating, Ventilating and Air Conditioning. Design and Analysis, 1994.
- Whitman W.C., Johnson W.M., Tomczyk, J.A. Refrigeration and Air Conditioning Technology, Concepts, Procedures, and Troubleshooting Techniques, Delmar Publishing, 7th edition, 2013.