COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Naval Architecture		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	NAOME1355	**SEMESTER**	8th
COURSE TITLE	**SPECIAL TOPICS IN COMBUSTION WITH APPLICATIONS IN MARINE ENGINES**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS (ECTS)**
Lectures	3	4

COURSE TYPE *general background, specialbackground, specialised general knowledge, skills development*	Specialised
PREREQUISITE COURSES:	NAOME1223 - INTERNAL COMBUSTION ENGINE
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/NA240/

(2) COURSE GOALS / LEARNING OUTCOMES

This course covers special topics in the theory of Combustion of all fuels~~)~~, with particular emphasis placed on the in-cylinder combustion process of liquid and gaseous fuels, as well as combinations of them. The increased utilization of Dual Fuel marine engines, as well as the expected use of non-fossil fossil fuel in the mid-term, necessitate the in depth understanding of the fundamental phenomena governing the combustion process.

The main aim is to familiarize the students with the complexity of the combustion phenomena involving elements from Thermodynamics, Fluid Mechanics, Heat and Mass transfer and Chemical Kinetics. The understanding of the mechanisms ~~creating~~ of the formation of pollutants and Greenhouse gases is quite essential and becomes even more important nowadays, given the current and future stringent regulations imposed by the IMO.

Upon the completion of the present course, the students will be able to

- Understand the basic combustion mechanisms of liquid and gaseous fuels
- Knows all the fuel characteristics relevant to their use in several practical technological systems
- Understand the various types of flames and their implementation in practical systems
- Analyse the pollutant formation mechanism, especially those related to in-cylinder processes.
- Know~~s~~ the relevant pollutant measurement systems employed in the marine sector
- Validate and propose strategies to lower emissions according to the current IMO standards
- Be aware of the alternative propulsion solutions considered for the marine sector, such as fuel cells

(3) COURSE CONTENT / SYLLABUS

Definition of Combustion – Historical perspective
Complexity of Combustion phenomena – Elements of Thermodynamics, Fluid Mechanics, Heat and Mass transfer, Chemical Kinetics.
Complete and Incomplete combustion, stoichiometry, Heat content of fuels
Laminar and Turbulent flames
Premixed and diffusion flames
Practical combustion systems for solid, liquid and gaseous fuels
Injection of liquid fuels – atomization – mixing with air - in-cylinder processes
Pollutant formation – Emission of Greenhouse gases: carbon dioxide and methane
Pollutant abatement methods
Pollutant and GHG measurement systems
Thermochemistry – Fuel cell systems

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	Face-to-face lectures & homework assignments
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*	
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*	Written examination (70%) ~~+~~ including theory questions and arithmetic exercises. ~~h~~Homework assignment based on bibliographic study (30%).

Activity	*Workload (hours)*
Lectures	29
Exercises	10
Homework assignments	30
Study of Lectures	48
Course total	117

(5) ATTACHED BIBLIOGRAPHY

- S Turns “An Introduction to Combustion: Concepts and Applications” 3rd Edition, McGraw-Hill, 2012
- Warnatz, J, Maas U, Dibble, R.W, “Combustion: physical and chemical fundamentals, modeling and simulation, experiments, pollutant formation”, 4th edition, Springer-Verlag, 2006