COURSE OUTLINE

(1) GENERAL

SCHOOL	**Engineering**		
ACADEMIC UNIT	Mechanical Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	EN0402	**SEMESTER**	6th
COURSE TITLE	Aerodynamics		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures and practice exercises	5	6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		
COURSE TYPE *general background, special background, specialized general knowledge, skills development*	Special background, specialized general knowledge, skills development	
PREREQUISITE COURSES:	There are no prerequisite courses. It is recommended that students who are interested in attending the course have completed successfully the following course: Fluid Mechanics I.	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek - English	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (tutoring)	
COURSE WEBSITE (URL)	https://www.mie.uth.gr/?page_id=18343&lang=en	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

This course aims to supply the undergraduate students with all the appropriate knowledge and skills that will allow them to understand aerodynamic principles of incompressible and compressible flows. The course is based on the exploitation of previously acquired knowledge by the students during core subjects of the earlier semesters. The main objective of the course is a student to be able to integrate this knowledge and extend it to more complex fluid mechanics problems.

Initially, basic principles and introductory concepts are presented along with the fundamental equations that govern aerodynamics. Then the course continues with incompressible frictionless flows around aerofoils, wings of finite span as well as general 3D incompressible flows. A significant part is devoted in frictionless compressible flows starting with the fundamental principles of compressible flows and then moving to normal and oblique shocks. Compressible flows in nozzles, diffusers and aerodynamic tunnels are also presented along with the isentropic flow equations. Moreover, the linear theory for subsonic compressible flows around aerofoils is presented as well as the linearised supersonic flows. A short introduction to hypersonic flows and to real viscous flows is also included. During the semester a laboratory experiment is also performed.

With the successful completion of this course the student will be able to:

- Know the principles and equations describing frictionless incompressible flows.

- Know the principles and equations describing frictionless compressible flows.
- Know to how to solve problems that contain normal or oblique shocks.
- Apply the linear theory for flows around aerofoils.
- Distinguish and mathematically describe subsonic, supersonic and hypersonic flows.
- Calculate drag and lift coefficients of idealised flows

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
thinking Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive
……
Others…
…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Decision-making
- Working independently
- Project planning and management
- Production of free, creative and inductive thought
- Adapting to new situations

(3) SYLLABUS

1. Basic principles, introductory concepts

2. Fundamental principles and equations.

3. Incompressible flows around aerofoils

4. Incompressible flows around wings of finite span

5. 3D incompressible flows

6. Basic principles of compressible flows

7. Normal and oblique shock. Expansion fans.

8. Compressible flows in nozzles, diffusers and aerodynamic tunnels.

9. Linear theory for subsonic compressible flows around aerofoils

10. Linerarised supersonic flows

11. Introduction to hypersonic flows

12. Introduction to real flows, basic principles and equations.

(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 of the learning process through the web platform e-class Use of powerpoint slides Upload of course material on the course's website Laboratory experiments Exercises, reports and presentation as evaluation methods
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*	see table below

Activity	*Semester workload*
Lectures	50
Practical exercises targeting on the understanding of the delivered theory	12
Laboratory exercise	8
Individual project and technical report for the solution of an idealized and of a real flow	21
Independent study	50
Educational visits	9
Course total	*150*

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* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	I. Individual project report (20%). Application of theory and methods on a technical report for the description of a laboratory experiment. II. Final examination (80%). Assessment of the delivered theory with multiple choice questions, problem solving and open-ended questions.

(5) ATTACHED BIBLIOGRAPHY

- ***-Suggested bibliography***: John Anderson, Fundamentals of Aerodynamics, 7th edition, McGrawHill, New York, 2023
- James E. John and Theo G. Keith, Gas Dynamics, 3rd Edition, Pearson Prentice Hall, New Jersey, 2006
- R. W. Fox, A. T. McDonald, P. J. Pritchard & J. W. Mitchell, Fluid Mechanics, 9th Edition (SI), Wiley, 2016
- R. M. Cummings, W. H. Mason, S. A. Morton & D. R. McDaniel, Applied Computational Aerodynamics – A modern Engineering Approach, Cambridge Aerospace Series

- Related academic journals:

- Journal of Fluid Mechanics
- AIAA Journal
- Progress in Aerospace Sciences
- Journal of Spacecraft and Rockets
- Physical Review Fluids