**ESOGU AERONAUTICAL ENGINEERING DEPARTMENT**

**COURSE INFORMATION FORM**

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| **Course Name** | **Course Code** |
| Compressible Aerodynamics | **152416001** |

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| **Semester** | **Number of Course Hours per Week** | **ECTS** |
| **Theory** | **Practice** |
| 6 | 3 | 0 | 5 |

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| **Course Category (Credit)** |
| **Basic Sciences** | **Engineering Sciences** | **Design** | **General Education** | **Social** |
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| **Course Language** | **Course Level** | **Course Type** |
| English | Undergraduate | Compulsory |

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| **Prerequisite(s) if any** |  |
| **Objectives of the Course** | This course aims to express the basic principles of compressible aerodynamics with equations, distinguish between normal and oblique shock waves, describe compressible flow in different platforms, develop supersonic flows and related numerical methods, and become familiar with hypersonic flows. It is aimed to reinforce the objectives with the notes and assignments kept in the lectures. |
| **Short Course Content** | Fundamentals of Compressible Flow, Normal Shock Waves and Related Topics, Oblique Shock and Expansion Waves, Compressible Flows in Nozzle-Diffuser and Wind Tunnels, Subsonic Compressible Flows over Wings, Supersonic Flow and Numerical Methods, Hypersonic Flow Fundamentals.  |

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| **Learning Outcomes of the Course** | **Contributed PO(s)**  | **Teaching Methods \*** | **Measuring Methods \*\*** |
| **1** | Explain the concept of compressible flow. | 1, 2, 4, 6 | 1, 2, 5 | A, B, D, E |
| **2** | Know the differences between normal and oblique shock and makes related equation inferences. | 1, 2, 4, 6 | 1, 2, 5, 8, 10 | A, B, D, E |
| **3** | Can identify different application areas of compressible flow. | 1, 2, 4, 6 | 1, 2, 5, 8, 10,13 | A, B, D, E |
| **4** | Apply the theories and related equations in subsonic and supersonic flows. | 1, 2, 4, 6 | 1, 2, 5, 8, 10,11, 13 | A, B, D, E |
| **5** | Can use numerical methods in this framework. | 1, 2, 4, 6 | 4, 8, 11,12 | A, B, D, E |
| **6** |  |  |  |  |
| **7** |  |  |  |  |
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| **Main Textbook** | ANDERSON. (2016). Fundamentals of aerodynamics (6th ed.). McGraw-Hill Education. |
| **Supporting References** | Peiqing Liu. (2022). A General Theory of Fluid Mechanics. Springer.Aerodynamics for Engineering Students, Sixth Edition, Houghton et al., Elsevier |
| **Necessary Course Material** | Projector, computer, textbook, A4 notebook, pencil, eraser, ruler, calculator |

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| **Course Schedule** |
| **1** |  Basic concepts of compressible flow |
| **2** |  Normal shock waves |
| **3** |  Normal shockwave equations |
| **4** |  Oblique shock waves |
| **5** |  Oblique shock waves equations |
| **6** |  Expansion waves |
| **7** |  Compressible flow applications |
| **8** | Mid-Term Exam |
| **9** |  Compressible flows in nozzle, diffuser and wind tunnels |
| **10** |  Subsonic compressible flows over the wing |
| **11** |  Supersonic flows |
| **12** |  Numerical methods for supersonic flows |
| **13** |  Hypersonic flows |
| **14** |  Project-homework presentations |
| **15** | General Review |
| **16,17** | Final Exam |

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| **Calculation of Course Workload** |
| **Activities** | **Number** | **Time (Hour)** | **Total Workload (Hour)** |
| Course Time (number of course hours per week) | 14 | 3 | 42 |
| Classroom Studying Time (review, reinforcing, prestudy,….) |  |  |  |
| Homework | 14 | 3 | 42 |
| Quiz Exam | 5 | 10 | 50 |
| Studying for Quiz Exam | 5 | 1 | 5 |
| Oral exam  |  |  |  |
| Studying for Oral Exam  |  |  |  |
| Report (Preparation and presentation time included) |  |  |  |
| Project (Preparation and presentation time included) |  |  |  |
| Presentation (Preparation time included) |  |  |  |
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| Mid-Term Exam | 1 | 2 | 2 |
| Studying for Mid-Term Exam | 1 | 5 | 5 |
| Final Exam | 1 | 2 | 2 |
| Studying for Final Exam | 1 | 5 | 5 |
|  | **Total workload** | **153** |
|  | **Total workload / 30** | **5,1** |
|  | **Course ECTS Credit** | **5** |

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| **Evaluation** |
| **Activity Type** | **%** |
| Mid-term | 15 |
| Quiz | 20 |
| Homework | 20 |
| Report | 15 |
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| **Final Exam** | 30 |
| **Total** | 100 |

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| **RELATIONSHIP BETWEEN THE COURSE LEARNING OUTCOMES AND THE PROGRAM OUTCOMES (PO)** (5: Very high, 4: High, 3: Middle, 2: Low, 1: Very low) |
| **NO** | **PROGRAM OUTCOME** | **Contribution** |
| **1** | Sufficient knowledge of engineering subjects related with mathematics, science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. | 5 |
| **2** | Ability to determine, define, formulate and solve complex engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | 5 |
| **3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. | 3 |
| **4** | Ability to develop, select and use modern methods and tools required for engineering applications; ability to effective use of information technologies. | 3 |
| **5** | In order to investigate engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. | 3 |
| **6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. | 4 |
| **7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. | 4 |
| **8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | 3 |
| **9** | Understanding of professional and ethical issues and taking responsibility  | 3 |
| **10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. | 2 |
| **11** | Knowledge of actual problems and effects of engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. | 2 |
| **12** |  |  |

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| **LECTUTER(S)** |
| **Prepared by** | Prof. Dr. Kürşad Melih GÜLEREN |  |  |  |
| **Signature(s)** |  |  |  |  |

**Date:** 10.07.2024