**ESOGU AERONAUTICAL DEPARTMENT**

**COURSE INFORMATION FORM**

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| **Course Name** | **Course Code** |
| PROPULSION SYSTEMS | 152416004 |

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

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| **Course Category (Credit)** |
| **Basic Sciences** | **Engineering Sciences** | **Design** | **General Education** | **Social** |
|  | X |  |  |  |

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| **Course Language** | **Course Level** | **Course Type** |
| English | Undergraduate | Compulsory |

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| **Prerequisite(s) if any** |  None |
| **Objectives of the Course** | Understanding how thrust is produced in jet engines,Calculating the ideal performance of all engine and engine components under different design conditions,Making performance calculations in conditions other than the design point,Understanding the amount of performance variation due to component losses in real conditions,To acquire the ability to use this information in the design process |
| **Short Course Content** | Introduction to Propulsion (Propulsion, Units and Dimensions,Operational Conditions and Standard Atmosphere, Air Breathing Engines,Aircraft Performance). Aircraft Gas Turbine Engine (Thrust Equation,Thrust Efficiency, Gas Turbine Engine Components, Brayton Cycle).Parametric Cycle Analysis of Ideal Engines (Engine Parametric CycleAnalysis, Ideal Ramjet, Ideal Turbojet, Ideal Turbofan). ComponentPerformance (Change in Gas Properties, Pressure Recovery in Air Intakeand Diffuser, Compressor and Turbine Efficiency, Combustion ChamberEfficiency and Pressure Loss, Exhaust Nozzle Loss, Shaft MechanicalEfficiency, Component Performance Criteria). Parametric Cycle Analysisof Real Engines (Turbojet, Turbofan). Engine Performance Analysis (GasGenerator, Turbojet Engine, Turbofan Engine). |

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| **Learning Outcomes of the Course** | **Contributed PO(s)**  | **Teaching Methods \*** | **Measuring Methods \*\*** |
| **1** | To understand how different aircraft engines are classified and to know the differences between them | X | 1, 5, 10,11 | A |
| **2** | Understanding how thrust is produced in aircraft engines | X | 1, 5, 10,11 | A |
| **3** | Understanding the key performance parameters of aircraft engines | X | 1, 5, 10,11 | A |
| **4** | To know how to use thermodynamic cycles in aircraft engine performance analysis, | X | 1, 5, 10,11 | A |
| **5** | Calculate the ideal performances of the aircraft engine and its components under design point conditions | X | 1, 5, 10,11 | A |
| **6** | Considering the losses in engine components, knowing their reflections on overall performance and understanding the effects of component performance | X | 1, 5, 10,11 | A |
| **7** | Calculating engine performance in real conditions and considering losses | X | 1, 5, 10,11 | A |
| **8** | Performing and evaluating aircraft engine performance analysis | X | 1, 5, 10,11 | A |

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| **Main Textbook** | Elements of Propulsion: Gas Turbines and Rockets, Mattingly, J.D.,AIAA Education Series, 2006. |
| **Supporting References** | Aerothermodynamics of Gas Turbine and Rocket Propulsion, ThirdEdition, G. C. Oates, AIAA Education Series, 1997 |
| **Necessary Course Material** | Computer |

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| **Course Schedule** |
| **1** | Introduction to Propulsion (Propulsion, Units and Dimensions, Operational Conditionsand Standard Atmosphere, Air Breathing Engines, Aircraft Performance) |
| **2** | Aircraft Gas Turbine Engine (Thrust Equation, Thrust Efficiency, Gas Turbine EngineComponents, Brayton Cycle) |
| **3** | Parametric Cycle Analysis of Ideal Engines (Engine Parametric Cycle Analysis, IdealRamjet) |
| **4** | Parametric Cycle Analysis of Ideal Engines (Ideal Turbojet) |
| **5** | Parametric Cycle Analysis of Ideal Engines (Ideal Turbofan) |
| **6** | Component Performance (Change in gas properties, Pressure Recovery in Air Intakeand Diffuser, Compressor and Turbine Efficiency, Combustion Chamber Efficiencyand Pressure Loss, Exhaust Nozzle Loss) |
| **7** | Component Performance (Summary of Component Performance Metrics, ComponentPerformance with Variable Cp), Parametric Cycle Analysis of Real Engines (Turbojet) |
| **8** | Mid-Term Exam |
| **9** | Parametric Cycle Analysis of Real Engines (Turbojet with Afterburner) |
| **10** | Parametric Cycle Analysis of Real Engines (Seperated Exhaust Flow Turbofan) |
| **11** | Engine Performance Analysis (Input, Gas Generator) |
| **12** | Engine Performance Analysis (Turbojet Engine) |
| **13** | Engine Performance Analysis (Turbofan Engine) |
| **14** | Review |
| **15** | 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,….) | 14 | 2 | 28 |
| Homework | 0 | 0 | 0 |
| Quiz Exam | 0 | 0 | 0 |
| Studying for Quiz Exam | 0 | 0 | 0 |
| Oral exam  | 0 | 0 | 0 |
| Studying for Oral Exam  | 0 | 0 | 0 |
| Report (Preparation and presentation time included) | 0 | 0 | 0 |
| Project (Preparation and presentation time included) | 0 | 0 | 0 |
| Presentation (Preparation time included) | 0 | 0 | 0 |
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| Mid-Term Exam | 1 | 1 | 1 |
| Studying for Mid-Term Exam | 14 | 2 | 28 |
| Final Exam | 1 | 1 | 1 |
| Studying for Final Exam | 14 | 2 | 28 |
|  | **Total workload** | **86** |
|  | **Total workload / 30** | **2.86** |
|  | **Course ECTS Credit** | **3** |

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| **Evaluation** |
| **Activity Type** | **%** |
| Mid-term | 40 |
| Quiz |  |
| Homework |  |
| Bir öğe seçin. |  |
| Bir öğe seçin. |  |
| **Final Exam** | 60 |
| **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 Aeronautical engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Aeronautical engineering problems. | 4 |
| **2** | Ability to determine, define, formulate and solve complex Aeronautical engineeringproblems for that purpose an ability to select and use convenient analytical and experimental methods | 4 |
| **3** | Ability to design a complex system, a component and/or an engineering process under reallife constrains or conditions, defined by environmental, economic and political problemsfor that purpose, an ability to apply modern design methods | 4 |
| **4** | Ability to develop, select and use modern methods and tools required for Aeronautical engineering applications; ability to effective use of information technologies | 4 |
| **5** | In order to investigate Mechanical 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. | 3 |
| **7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language | 1 |
| **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 | 1 |
| **10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. | 1 |
| **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 ofengineering solutions. | 1 |

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| **LECTUTER(S)** |
| **Prepared by** |  |  |  |  |
| **Signature(s)** |  |  |  |  |

**Date:**06.06.2024