**ESOGU MECHANICAL ENGINEERING DEPARTMENT**

**COURSE INFORMATION FORM**

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| **Course Name** | **Course Code** |
| Engineering Thermodynamics-I | 151814244 |

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| **Semester** | **Number of Course Hours per Week** | | **ECTS** |
| **Theory** | **Practice** |
| 4 | 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** |
| Turkish | Undergraduate | Compulsory |

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| **Prerequisite(s) if any** | - |
| **Objectives of the Course** | To explain in detail the basic thermodynamic principles and their  applications, the importance of heat and work, heat engines, refrigeration systems,  heat pump systems, cycles, power generation systems and major components used in  these systems and their analyses, and give basic information about losses and  efficiencies. |
| **Short Course Content** | Basic concepts of thermodynamics, Pure substance, the first law of thermodynamics  for closed systems and control volumes, Carnot cycle and the second law of  thermodynamics |

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| **Learning Outcomes of the Course** | | **Contributed PO(s)** | **Teaching Methods \*** | **Measuring Methods \*\*** |
| **1** | Defines pure matter, phases, state changes, property diagrams, ideal gases and calculates their physical properties | 1, 2, 5, 6, 7 | 1, 2, 5, 10, 11 | A, B |
| **2** | Describe the zeroth and first laws of thermodynamics and apply them to open/closed, steady state/transient systems | 1, 2, 6, 7 | 1, 2, 5, 10, 11 | A, B |
| **3** | Define reversible and irreversible state changes and relate them to the Carnot cycle. | 1, 2, 6, 7 | 1, 2, 5, 10, 11 | A, B |
| **4** | Defines heat engine, heat pumps and refrigerators, makes and interprets efficiency and performance calculations | 1, 2, 6, 7 | 1, 2, 5, 10, 11 | A, B |
| **5** | Defines entropy and the second law of thermodynamics and relates them to each other. | 1, 2, 6, 7 | 1, 2, 5, 10, 11 | A, B |
| **6** | Defines isentropic change of state and calculates and interprets the isentropic efficiency of closed/open systems | 1, 2, 6, 7 | 1, 2, 5, 10, 11 | A, B |
| **7** | Defines entropy balance and applies it to closed/open systems, calculates and interprets entropy production | 1, 2, 3, 6, 7 | 1, 2, 5, 10, 11 | A, B |
| **8** | Establishes the relationship between energy, efficiency, sustainability and environment. | 8, 9, 10, 11 | 1, 2, 5, 10, 11 | A, B |

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| **Main Textbook** | Yunus Ali Çengel ve Michael A. Boles, Çeviri Editörü: Ali PINARBAŞI, “TERMODİNAMİK, Mühendislik Yaklaşımıyla”, 5. Baskı, İzmir Güven Kitabevi, 2008. |
| **Supporting References** | Micheal J. Moran and Howard M. Shapiro, “Fundamentals of Engineering Thermodynamics”, Wiley, 2020.  Claus Borgnakke and Richard E. Sonntag, “Thermodynamic and Transport Properties”, John Wiley & Sons, Inc., 1997. |
| **Necessary Course Material** |  |

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| **Course Schedule** | |
| **1** | Introduction to Engineering Thermodynamics – I. Basic Concepts of Thermodynamics. |
| **2** | Pure substance, its phases, phase change processes, property diagrams |
| **3** | Property tables, the ideal-gas equation of state, compressibility factor. |
| **4** | Heat, work, the first law of Thermodynamics for closed systems. |
| **5** | The internal energy, enthalpy, and specific heats of ideal gases |
| **6** | The first law of Thermodynamics for control volumes , steady-flow engineering devices |
| **7** | The first law of Thermodynamics for control volumes , steady-flow engineering devices |
| **8** | Mid-Term Exam |
| **9** | Transient control volumes |
| **10** | Reversible and irreversible processes, Carnot cycle |
| **11** | The Carnot heat engine, the Carnot refrigerator and heat pump. |
| **12** | The Carnot heat engine, the Carnot refrigerator and heat pump |
| **13** | Second-law analysis of engineering systems |
| **14** | Second-law analysis of engineering systems |
| **15** | Second-law analysis of engineering systems |
| **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 | 3 | 42 |
| Homework |  |  |  |
| Quiz Exam |  |  |  |
| Studying for Quiz Exam |  |  |  |
| Oral exam |  |  |  |
| Studying for Oral Exam |  |  |  |
| Report (Preparation and presentation time included) |  |  |  |
| Project (Preparation and presentation time included) |  |  |  |
| Presentation (Preparation time included) |  |  |  |
| Mid-Term Exam | 1 | 2 | 2 |
| Studying for Mid-Term Exam | 1 | 18 | 18 |
| Final Exam | 1 | 2 | 2 |
| Studying for Final Exam | 1 | 36 | 36 |
|  | **Total workload** | | **142** |
|  | **Total workload / 30** | | **4.73** |
|  | **Course ECTS Credit** | | **5** |

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| **Evaluation** | |
| **Activity Type** | **%** |
| Mid-term | 50 |
| **Final Exam** | 50 |
| **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 Mechanical engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Mechanical engineering problems. | 5 |
| **2** | Ability to determine, define, formulate and solve complex Mechanical 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, economic and political problems  for that purpose, an ability to apply modern design methods | 1 |
| **4** | Ability to develop, select and use modern methods and tools required for Mechanical engineering applications; ability to effective use of information technologies | 1 |
| **5** | In order to investigate Mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. | 1 |
| **6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence effectively in inner or multi-disciplinary teams; proficiency of | 4 |
| **7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language | 3 |
| **8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | 4 |
| **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 |

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| **LECTUTER(S)** | | | | |
| **Prepared by** | Prof. Dr. Haydar ARAS | Prof. Dr. M. Ertunç TAT | Assoc. Prof. Dr. Bahadır DOĞAN | Asst. Prof. Dr. Çisil TİMURALP |
| **Signature(s)** |  |  |  |  |

**Date:**06.06.2024