**ESOGU MECHANICAL ENGINEERING DEPARTMENT**

**COURSE INFORMATION FORM**

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| **Course Name** | **Course Code** |
| HEAT TREATMENT OF METALS | 151817660 A |

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| **Semester** | **Number of Course Hours per Week** | **ECTS** |
| **Theory** | **Practice** |
| 7 | 3 | 0 | 5 |

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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** |
| Turkish | Undergraduate | Elective |

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| **Prerequisite(s) if any** | None |
| **Objectives of the Course** | Teaching that the internal structure of materials has an important effect on mechanical properties and that mechanical properties can be improved by intervening in these internal structures through heat treatments. |
| **Short Course Content** | Fe-C phase diagram, effect of alloying elements on Fe-C phase diagram, austenitic transformation, TTT and CCT diagrams, fundamentals of martensitic transformations, quenching and tempering of steel, surface hardening, heat treatment of non-ferrous metals, heat treatment defects, precipitation hardening, heat treatment equipments |

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| **Learning Outcomes of the Course** | **Contributed PO(s)**  | **Teaching Methods \*** | **Measuring Methods \*\*** |
| **1** | Interpret the Fe-C phase diagram and the effect of alloying elements on the Fe-C phase diagram, | 1, 2, 5, 6 | 1, 5, 8, 10, 15 | A, D, G, F, K |
| **2** | Understands the basic principle of heat treatment | 1, 2, 5, 6 | 1, 5, 8, 10, 15 | A, D, G, F, K |
| **3** | Understand and interpret the mechanisms that increase hardness in steels | 1, 2, 5, 6 | 1, 5, 8, 10, 15 | A, D, G, F, K |
| **4** | Interpret the relationship between heat treatment and mechanical properties | 1, 2, 5, 6 | 1, 5, 8, 10, 15 | A, D, G, F, K |
| **5** | Can use TTT and CCT diagrams | 1, 2, 5, 6 | 1, 5, 8, 10, 15 | A, D, G, F, K |
| **6** | Precipitation hardening and its applications can be realized | 1, 2, 5, 6 | 1, 5, 8, 10, 15 | A, D, G, F, K |

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| **Main Textbook** | G. E. Totten (Ed.), Steel heat treatment: Metallurgy and Technologies”, Boca Raton, FL : Taylor & Francis, 2007. |
| **Supporting References** | 1. ASM Handbook V.4, Heat Treatment2. Malzeme Bilimi ve Mühendisliği, Smith, W.F., Çev.Kınıkoğlu, N.G., Literatür Yay.3. Malzemelerin Yapı ve Özellikleri, I-II-III-IV, Moffat, W.G., Pearsall, G.W., Wulff, J., Çev. Onaran, K., Erman, B., İTÜ Yay. |
| **Necessary Course Material** | Projector |

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| **Course Schedule** |
| **1** | Steel materials, definitions |
| **2** | Manufacture and standard designations of steel materials |
| **3** | General heat treatments and Fe-C phase diagram |
| **4** | TTT and CCT diagrams |
| **5** | Hardening, Normalization and stress relief |
| **6** | Recrystallization, softening annealing |
| **7** | Martempering |
| **8** | Mid-Term Exam |
| **9** | Austempering |
| **10** | Surface hardening heat treatments, cementation |
| **11** | Nitriding, boriding, surface hardening by creating a composite structure on the surface |
| **12** | Induction and flame surface hardening |
| **13** | Damage analysis of heat treated parts |
| **14** | Damage analysis of heat treated parts |
| **15** | Submission of student assignments |
| **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 |  |  |  |
| Quiz Exam |  |  |  |
| Studying for Quiz Exam |  |  |  |
| Oral exam  |  |  |  |
| Studying for Oral Exam  |  |  |  |
| Report (Preparation and presentation time included) | 1 | 30 | 30 |
| Project (Preparation and presentation time included) |  |  |  |
| Presentation (Preparation time included) | 1 | 20 | 20 |
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| Mid-Term Exam | 1 | 1.5 | 1.5 |
| Studying for Mid-Term Exam | 1 | 30 | 30 |
| Final Exam |  |  |  |
| Studying for Final Exam |  |  |  |
|  | **Total workload** | **146.5** |
|  | **Total workload / 30** | **4.88** |
|  | **Course ECTS Credit** | **5** |

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| **Evaluation** |
| **Activity Type** | **%** |
| Mid-term | 50 |
| Quiz |  |
| Homework | 50 |
| Bir öğe seçin. |  |
| Bir öğe seçin. |  |
| **Final Exam** |  |
| **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** | Adequate knowledge of mathematics, science and Mechanical Engineering; ability to apply theoretical and practical knowledge in these fields to model and solve Mechanical Engineering problems. | 4 |
| **2** | Ability to identify, define, formulate and solve complex engineering problems in Mechanical Engineering and related fields by selecting and applying appropriate analysis and modeling methods. | 5 |
| **3** | Ability to design a complex system, device or product for a specified purpose under realistic constraints and conditions by applying modern design methods. | 3 |
| **4** | Ability to develop, select, use modern techniques and tools required for Mechanical Engineering applications and to effectively utilize information technologies. | 3 |
| **5** | Ability to design and conduct experiments, collect data, analyze and interpret results to investigate Mechanical Engineering problems. | 4 |
| **6** | Ability to work individually, within disciplines and in interdisciplinary teams | 4 |
| **7** | Ability to communicate effectively in Turkish, both verbally and in writing, and to use/improve foreign language knowledge | 3 |
| **8** | Awareness of the necessity of lifelong learning; ability to access information, follow developments in science and technology, and constantly renew oneself. | 3 |
| **9** | Awareness of professional and ethical responsibility | 2 |
| **10** | Knowledge of business practices such as project management, risk management and change management; awareness of entrepreneurship, innovation and sustainable development | 1 |
| **11** | Knowledge of the global and societal impacts of engineering practices on health, the environment and safety; awareness of national and international legal regulations and standards and the legal implications of engineering solutions. | 3 |

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| **LECTUTER(S)** |
| **Prepared by** | Assistant Professor Dr. ABDULLAH SERT |
| **Signature(s)** |  |

**Date:**06.06.2024