**ESOGU MECHANICAL ENGINEERING DEPARTMENT**

**COURSE INFORMATION FORM**

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| **Course Name** | **Course Code** |
| Heat Transfer | 151816XXX |

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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** |
| Turkish | Undergraduate | Compulsory |

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| **Prerequisite(s) if any** |  |
| **Objectives of the Course** | To provide students with the basic physics of heat transfer by conduction, convection and radiation. Students are instructed in the analysis and solution of basic heat transfer problems, as supplemented by practical charts and tables as well as empirical correlations. |
| **Short Course Content** | Heat transfer mechanisms, steady heat conduction, thermal resistances, fins. Transient conduction, lumped capacitance method, product solutions. Forced convection; boundary layers, laminar and turbulent flow, convective transfer boundary layer equations, dimensionless parameters. External forced convection, empirical correlations. Internal flow correlations. Natural convection. Thermal radiation, radiation heat transfer between black bodies, between diffuse gray surfaces, radiation exchange with emitting and absorbing gases. |

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| **Learning Outcomes of the Course** | **Contributed PO(s)**  | **Teaching Methods \*** | **Measuring Methods \*\*** |
| **1** | Learning the mechanism of heat transfer and thermal characteristics of the environment. | 1,2,6 | 1,11 | A |
| **2** | Learning the basic concepts of heat transfer by conduction and making calculations. | 1,2,6 | 1,11 | A |
| **3** | Understanding the convective heat transfer calculations and applications. | 1,2,6 | 1,11 | A |
| **4** | Learning the basic concepts of heat transfer by radiation and making calculations | 1,2,6 | 1,11 | A |
| **5** | Analyzing the heat transfer problems, resolving and gaining the ability to interpret the results. | 1,2,6 | 1,11 | A |
| **6** |  |  |  |  |
| **7** |  |  |  |  |
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| **Main Textbook** | T.L. Bergman, A.S. Lavine, F.P. Incropera and D.P. Dewitt, “Fundamentals of Heat and Mass Transfer”, 7th Ed., 2011. |
| **Supporting References** | Y.A. Çengel and A.J. Ghajar, "Heat and Mass Transfer, Fundamentals and Applications", 4th Ed., WCB/McGraw-Hill, 2011. |
| **Necessary Course Material** |  |

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| **Course Schedule** |
| **1** | Basic of Heat Transfer: Heat transfer mechanisms, conduction, thermal conductivity, convection and radiation, simultaneous heat transfer mechanisms. |
| **2** | Heat Conduction: General heat conduction equation, boundary and initial conditions, steady one dimensional heat conduction, heat generation in a solid, variable heat conduction |
| **3** | Steady Heat Conduction: steady one dimensional heat conduction, heat generation in a solid, variable heat conduction |
| **4** | Steady Heat Conduction: Steady heat conduction in plane walls |
| **5** | Steady Heat Conduction: Thermal contact resistance, generalized thermal resistance networks, heat conduction in cylinders and spherical, Critical radius of insulation |
| **6** |  Steady Heat Conduction: Heat transfer from finned surfaces, fin equation, fin efficiency, fin effectiveness |
| **7** | Transient Heat Conduction: Lumped system analysis, transient conduction in large plane walls, long cylinders and spheres. |
| **8** | Mid-Term Exam |
| **9** | Forced Convection: Fundamentals of convection, classification of fluid flows, velocity boundary layer, thermal boundary layer, basic equations |
| **10** | External Forced Convection: Drag force and heat transfer in external flow, parallel flow over flat plates, flow across cylinders and spheres |
| **11** | Internal Forced Convection: Mean velocity, mean temperature, the entry region, constant surface heat flux and temperature boundary conditions, laminar flow in the tubes |
| **12** |  Natural Convection: Physical mechanism, natural convection over surfaces and inside enclosures, combined natural and forced convection |
| **13** | Thermal Radiation: Blacbody radiation, radiation intensity, radiative properties, Kirchhoff`s law, atmospheric and solar radiation, view factor and veiw factor relations |
| **14** |  Radiation Heat Transfer: Radiation heat transfer between black surfaces, between diffuse gray surfaces, radiation shields |
| **15** |  Radiation Heat Transfer:Rradiation exchange with emitter and absorber gases |
| **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 | 4 | 56 |
| 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) |  |  |  |
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| Mid-Term Exam | 1 | 2 | 2 |
| Studying for Mid-Term Exam | 1 | 14 | 14 |
| Final Exam | 1 | 2 | 2 |
| Studying for Final Exam | 1 | 20 | 20 |
|  | **Total workload** | **136** |
|  | **Total workload / 30** | **4.53** |
|  | **Course ECTS Credit** | **5** |

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| **Evaluation** |
| **Activity Type** | **%** |
| Mid-term | 50 |
| Quiz |  |
| Homework |  |
| Bir öğe seçin. |  |
| Bir öğe seçin. |  |
| **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 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. | 2 |
| **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. | 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  | 4 |
| **10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. | 4 |
| **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 |  |  |  |
| **Signature(s)** |  |  |  |  |

**Date:**10.07.2024