Course Description Form

Course Code and Name	ME309 HEAT TRANSFER
Course Semester	5
Catalog Content	Heat transfer mechanisms, steady heat conduction, thermal resistances, fins. Transient conduction, lumped capacitance method, product solutions. Numerical methods in steady heat conduction and in transient heat conduction. Forced convection; boundary layers, laminar and turbulent flow, convective transfer boundary layer equations, dimensionless parameters, Reynolds analogy. 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.
Textbook	Y.A. Çengel and A.J. Ghajar, "Heat and Mass Transfer, Fundamentals and Applications", 4^{th} Ed., WCB/McGraw-Hill, 2011.
Supplementary Textbooks	T.L. Bergman, A.S. Lavine, F.P. Incropera and D.P. Dewitt, “Fundamentals of Heat and Mass Transfer”, 7th Ed., 2011.
Credit	5
Prerequisites of the Course (Attendance Requirements)	ME203 THERMODYNAMICS 1
Type of the Course	Compulsory
Instruction Language	English
Course Objectives	The course is designed to give third year mechanical engineering students the fundamental 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.
Course Learning Outcomes	1. Learning the mechanism of heat transfer and thermal characteristics of the environment. 2. Learning the basic concepts of heat transfer by conduction and making calculations. 3. Understanding the convective heat transfer calculations and applications. 4. Learning the basic concepts of heat transfer by radiation and making calculations. 5. Analyzing the heat transfer problems, resolving and gaining the ability to interpret the results.
Instruction Methods	The mode of delivery of this course is face to face
Weekly Schedule	

1. Week	Basic of Heat Transfer: Heat transfer mechanisms, conduction, thermal conductivity, convection and radiation, simultaneous heat transfer mechanisms.
2. Week	Heat Conduction: General heat conduction equation, boundary and initial conditions, setady one dimensional heat conduction, heat generation in a solid, variable heat conduction
3. Week	Steady Heat Conduction: Steady heat conduction in plane walls, thermal contact resistance, generalized thermal resistance networks, heat conduction in cylinders
4. Week	Steady Heat Conduction: Critical radius of insulation, heat transfer from finned surfaces, fin equation, fin efficiency, fin effectiveness.
5. Week	Transient Heat Conduction: Lumped system analysis, transient conduction in large plane walls, long cylinders and spheres.
6. Week	Numerical Methods in Steady Conduction: One and two dimensional transient heat conduction, controlling numerical error.

7. Week	Numerical Methods in Transient Conduction: One and two dimensional transient heat conduction, controlling numerical error.
8. Week	Midterm 1:Forced Convection: Fundamentals of convection, classification of fluid flows, velocity boundary layer, thermal boundary layer, basic equations
9. Week	Forced Convection: Fundamentals of convection, classification of fluid flows, velocity boundary layer, thermal boundary layer, basic equations
10. Week	External Forced Convection: Drag force and heat transfer in external flow, parallel flow over flat plates, flow across cylinders and spheres
11. Week	Internal Forced Convection: Mean velocity, mean temperature, the entry region, constant surface heat flux and temperature boundary conditions, laminar flow in the tubes
12. Week	Natural Convection: Physical mechanism, natural convection over surfaces and inside enclosures, combined natural and forced convection.
13. Week	Midterm 2: Thermal Radiation: Blacbody radiation, radiation intensity, Kirchhoff's law, atmospheric and solar radiation, view factor and view factor relations
14. Week	Radiation Heat Transfer: Radiation heat transfer between black surfaces, between diffuse gray surfaces, radiation shields, radiation exchange with emitter and absorber gases.
15. Week	Final Exam

Teaching and Learning Methods

(These are examples. Please fill which activities you use in the course)

Weekly theoretical course hours:3
Weekly applied course hours:1
Reading Activities: 2
Internet browsing, library work:1
Preparation of Midterm and Midterm Exam: 10
Final Exam and Preparation for Final Exam: 10

Assessment Criteria

	Numbers	Total Weighting (%)
Midterm Exams	2	40
Assignment	-	-
Application	-	-
Projects	-	-
Practice	-	-
Quiz	4	20
Percent of In-term Studies (%)		60
Percentage of Final Exam to Total Score (%)		40
Attendance		70

Workload

Activity	Total Number of Weeks	Duration (weekly hour)	Total Period Work Load
Weekly Theoretical Course Hours	14	3	42
Weekly Tutorial Hours	14	1	14
Reading Tasks	14	2	28
Studies	11	1	11
Material Design and Implementation			
Report Preparing			

Preparing a Presentation			
Presentations			
Midterm Exam and Preperation for Midterm Exam	2	10	20
Final Exam and Preperation for Final Exam	1	10	10
Other (should be emphasized)			
Total Workload			125
Total Workload / 25			5.0
Course Credit (ECTS)			5

Contribution Level Between Course Learning Outcomes and Program Outcomes

No	Program Outcomes	1	2	3	4	5
1	Adequate knowledge of subjects specific to mathematics, natural sciences and related engineering disciplines; ability to use theoretical and applied knowledge related to these areas in complex engineering problems.					X
2	Ability to identify, define, formulate, and solve complex engineering problems; ability to select and apply appropriate analysis and modeling methods to this end.					X
3	Ability to design a complex system, process, device or product under realistic constraints and conditions to meet specific requirements; ability to apply modern design methods for this purpose.					
4	Ability to develop, select and use modern techniques and tools required for the analysis and solution of complex problems encountered in engineering practice; ability to use information technologies effectively.					
5	Ability to design and conduct experiments, collect data, analyze and interpret results to investigate complex engineering problems or discipline-specific research topics				X	
6	Ability to work effectively in disciplinary and multi-disciplinary teams; ability to work individually.					
7	Ability to communicate effectively in Turkish, both orally and in writing; knowledge of at least one foreign language; the ability to write effective reports and understand written reports, to prepare design and production reports, to deliver effective presentations, to give and receive clear and understandable instructions.					
8	Awareness of the necessity of lifelong learning; the ability to access information, to follow developments in science and technology, and to renew oneself constantly.					
9	Acting in accordance with ethical principles, professional and ethical responsibility; information about standards used in engineering applications.					
10	Information about business life practices such as project management, risk management and change management; awareness of entrepreneurship, innovation; information about sustainable development.					
11	Knowledge about the universal and social effects of engineering applications on health, environment and safety and the problems of the age reflected in the engineering field; awareness of the legal consequences of engineering solutions.					

The Course's Lecturer(s) and Contact Informations	Prof. Dr. Şenol BAŞKAYA, Prof. Dr. İlhami HORUZ, Prof. Dr. Atilla BIYIKOĞLU, Doç. Dr Oğuz TURGUT baskaya@gazi.edu.tr, ilhamihoruz@gazi.edu.tr, abiyik@gazi.edu.tr, oturgut@gazi.edu.tr