

MM 491 Steam Boilers				DEPARTMENT OF MECHANICAL ENGINEERING					
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project / Field Study	Homework	Other	Total	Credit	ECTS Credit
7	42	0	10	10	13	-	75	3	3.0
Language	Turkish								
Compulsory / Elective	Elective								
Prerequisites	MM 312								
Course Contents	Fundamental concepts. Classification of steam boilers. Fuels and fuel preparation system. Combustion and combustion systems. Combustion calculations. Boiler performance and boiler design. Heat transfer in steam boilers and calculation of heat transfer surfaces. Boiler draft calculations and draft calculations systems.								
Course Objectives	To introduce the importance, fundamental design approaches and applications of steam boilers in engineering. To teach and apply basic methods for analysis, design and optimization of boilers.								
Learning Outcomes and Competences	Understanding of the technical, economical and environmental aspects of steam generators, their design and application in economical sectors, and application of engineering analysis, design and optimization methods for boiler development, design, operation and optimization.								
Textbook and / or Reference	1) P.BASU, C.KEFA, L.JESTİN, Boilers and Burnes, Springer-Verlag, 2000. 2) Onat K., O.F.Genceli, A.Arisoy, "Buhar Kazanlarının Isıl Hesapları", ISBN 975-7518-00, 1988, İstanbul. 3) Boiler Standards.								
Assessment Criteria						If any, mark as (x)		Percentage (%)	
	Midterm Exams					2		40	
	Quizzes					5		10	
	Homeworks					1		10	
	Projects								
	Term Paper								
	Laboratory Work								
	Other								
Final Exam					X		40		
Instructors	Assist.Prof. Huseyin TOPAL								
Week	Subject								
1	Introduction: Importance of boilers in energy and environmental economy. Developments in boiler technology.								
2	Classification of boilers, and boiler system structures. Boiler applications in different economical sectors.								
3	Engineering approaches used in the boiler design. Examining the effects of fuel type and properties on the boiler design, design calculations, boiler load conditions and selection of fuel and boiler types.								
4	Boiler thermal design calculations. Thermal performance calculations based on nominal boiler load. Fuel consumption and chimney gas temperature calculations.								
5	Boiler thermal design: Combustion calculations, calculation of flame emissivity and condensation temperature of chimney gas. Thermodynamic properties of flue gases. Determining the air and flue gas velocities in boiler sections.								
6	Steam generation process design. Calculation of heat loads and thermodynamic properties of workingfluid in heating surfaces such as feed water heater, evaporator, reheater and air preheater.								
7	Combustion chamber design. Specific volumetric and cross-sectional heat loads of combustion chamber. Calculation of soot, gas and partial emissivities in combustion chambers.								
8	Midterm I. Solutions of design oriented sample problems.								
9	Calculation of the adiabatic combustion chamber temperature and the combustion gas temperatures at the outlets of heating surfaces. Calculation of film coefficients, total heat transfer coefficients, logarithmic mean temperature differences.								
10	Iterative calculations of the boiler heating surface areas in order to realize the nominal thermal performance conditions. Checking of the exterior and interior energy balances of boilers. Calculation of the heat transfer surface areas and pipe lengths.								
11	Mechanical design of boilers: Mechanical design and manufacturing of heating surfaces and their locations in the boiler passages. Stress calculations of boiler heating surfaces. Boiler materials and their selection. Determination of boiler critical points and taking the necessary design measures.								
12	Midterm II. Boiler thermal efficiency and emission tests.								
13	Boiler draft systems design: Draft loss, fan and chimney calculations. Experimental determination of combustion, boiler thermal performance and emissions. Emission factors and emission calculations.								
14	Fuel preparation, combustion, feed water purification systems and flue gas filtering systems for particles, SO2, and NOx.								