

DEPARTMENT OF ENERGY SCIENCE AND TECHNOLOGY COURSE SYLLABUS

Course Details									
Code				Acad	Academic Year			Semester	
EBT306					3				
Title				Т	Α	L	ECTS		
Heat Transfer				3	2	0	6		
Language	German								
Level	Undergraduate X Graduate Postgraduate								
Department / Program	Energy Science and Technologies								
Forms of Teaching and Learning	Face-to-face								
Course Type	Compulsory X Elective								
Objectives	The main aim of the course is to teach the basic concepts of thermodynamics and the first and second laws of thermodynamics. demonstrate the fundamentals of thermal design of engineering systems. To improve students' analysis, application and communication skills in this field.								
Content	Thermodynamic systems and their properties. Thermodynamic processes; work and heat interactions. Pure substances and thermodynamic properties. First Law; closed and open systems, flow processes. The Second Law; Heat machines, heat pumps and coolers. Entropy								
Prerequisites	None								
Coordinator									
Lecturer(s)									
Assistant(s)									
Work Placement	None								
Recommended or Required R	Reading								
Books / Lecture Notes	1) Incropera F.P., Bergman T.L., Lavine A.S., & Dewitt D.P., 1981, Isı ve Kütle Geçişini Temelleri, Literatür Yayıncılık. 2) Çengel, Y.A., & Ghajar, A.J., 2014, Isı ve Kütle Transferi (4. baskı)								
Other Sources									
Additional Course Material									
Documents									
Assignments									
Exams									
Course Composition									
Mathematics und Basic Sciences	10			%					
Engineering	30			%					
Engineering Design	0 %								



DEPARTMENT OF ENERGY SCIENCE AND TECHNOLOGY COURSE SYLLABUS

Social Sciences		0	%			
Educational Scie	nces	0	%			
Natural Sciences	i	20	%			
Health Sciences		0	%			
Expert Knowledg	ge	40)	%		
Assessment						
Activ	rity	Percentage (%)				
Midterm Exam		1		30		
Quiz		0		0		
Assignments		1		10		
Attendance		0		0		
Recitations		0		0		
Projects		1	20			
Final Exam		1		40		
			Total	100		
ECTS Points and Work Load						
Activity		Count	Duration	Work Load (Hours)		
Lectures		13	3	39		
Self-Study		14	6	84		
Assignments		1	6	6		
Presentation / Seminar Preparation		0 0		0		
Midterm Exam		1	2	2		
Recitations		14	2	28		
Laboratory		0	0	0		
Projects		1 12		12		
Final Exam		1	2			
	Total Work Load 173					
ECTS Points (Total Work Load / Hours) 6						
Learning Outco	omes					
To be able to explain the basic physical laws of heat transfer, to determine the heat transfer modes for the given situations and to make appropriate approximations.						
2	To be able to calculate the heat transfer and temperature distribution of one-dimensional heat					
3	For non-planar geometries, in one-dimensional heat conduction; be able to describe the effect of time dependency of production on the temperature distribution					
4	To be able to calculate the amount of heat transfer for finned surfaces and various geometries and semi-infinite bodies					
5		To be able to explain convection equations and terms in heat transfer				
		•				



DEPARTMENT OF ENERGY SCIENCE AND TECHNOLOGY COURSE SYLLABUS

Finding heat transfer coefficients for forced convection from co-relationships To be able to make estimations for basic geometries in a moving fluid by means of fluid/heat transfer analogy. In heat transfer with radiation; To be able to explain basic concepts with wavelength, source and direction effects 9 To be able to calculate radiative heat transfer rates for black bodies or gray bodies Weekly Content 1 Basic mechanisms of heat transfer, definitions 2 Heat conduction equation and Initial and Boundary conditions 3 Heat transfer with neo-dimensional conduction in steady state 4 Heat transfer with two-dimensional conduction in steady state 5 Numerical methods in heat conduction 6 Time dependent heat conduction 7 Fundamentals of transport, velocity and thermal boundary layers, dimensionless numbers 8 Midterm 9 Internal and external flow in forced transportation 10 Heat pipes and heat exchangers 11 Fundamentals of heat transfer by radiation 12 Blackbody radiation, Stefan-Boltzmann law 13 Radiation heat transfer between black and gray surfaces and its applications 14 Applications in heat transfer by radiation 15 Final exam Contribution of Learning Outcomes to Program Objectives (1-5) P1 P2 P3 P4 P5 P6 P7 1 5 5 5 4 5 5 3 1 1 2 5 5 5 4 5 5 3 1 1 3 5 5 5 4 5 5 5 3 1 1 4 6 5 5 5 3 1 1 5 5 5 5 4 5 5 5 3 1 1 6 6 5 5 5 4 5 5 5 3 1 1 7 5 5 5 4 5 5 5 3 1 1 8 5 5 5 5 5 5 5 5 5 5 5 5 3 1 1 8 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 3 1 9 5 5 5 4 5 5 5 3 1 1 Contribution level 1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High				COOKSES	ILLADOS			
In heat transfer with radiation; To be able to explain basic concepts with wavelength, source and direction effects To be able to calculate radiative heat transfer rates for black bodies or gray bodies Weekly Content Basic mechanisms of heat transfer, definitions Heat conduction equation and initial and Boundary conditions Heat transfer with one-dimensional conduction in steady state Heat transfer with two-dimensional conduction in steady state Heat transfer with two-dimensional conduction Time dependent heat conduction Fundamentals of transport, velocity and thermal boundary layers, dimensionless numbers Midterm Internal and external flow in forced transportation Heat pipes and heat exchangers Internal and external flow in forced transportation Blackbody radiation, Stefan-Boltzmann law Radiation heat transfer between black and gray surfaces and its applications Applications in heat transfer by radiation Final exam Contribution of Learning Outcomes to Program Objectives (1-5) Contribution of Learning Outcome	6	Finding heat	transfer coeffi	cients for force	ed convection	from co-relatio	nships	
Weekly Content	7							
Weekly Content 1 Basic mechanisms of heat transfer, definitions 2 Heat conduction equation and Initial and Boundary conditions 3 Heat transfer with one-dimensional conduction in steady state 4 Heat transfer with two-dimensional conduction in steady state 5 Numerical methods in heat conduction 6 Time dependent heat conduction 7 Fundamentals of transport, velocity and thermal boundary layers, dimensionless numbers 8 Midterm 9 Internal and external flow in forced transportation 10 Heat pipes and heat exchangers 11 Fundamentals of heat transfer by radiation 12 Blackbody radiation, Stefan-Boltzmann law 13 Radiation heat transfer between black and gray surfaces and its applications 14 Applications in heat transfer by radiation 15 Final exam Contribution of Learning Outcomes to Program Objectives (1-5) 1 P1 P2 P3 P4 P5 P6 P7 1 5 5 4 5 5 3 1	8		In heat transfer with radiation; To be able to explain basic concepts with wavelength, source and					
Heat conduction equation and Initial and Boundary conditions Heat transfer with one-dimensional conduction in steady state Heat transfer with two-dimensional conduction in steady state Numerical methods in heat conduction Time dependent heat conduction Fundamentals of transport, velocity and thermal boundary layers, dimensionless numbers Midterm Internal and external flow in forced transportation Heat pipes and heat exchangers In Fundamentals of heat transfer by radiation Blackbody radiation, Stefan-Boltzmann law Radiation heat transfer between black and gray surfaces and its applications Applications in heat transfer by radiation Final exam Contribution of Learning Outcomes to Program Objectives (1-5) P1 P2 P3 P4 P5 P6 P7 1 5 5 5 4 5 5 3 1 2 5 5 5 4 5 5 3 1 3 5 5 5 4 5 5 3 1 4 5 5 5 3 1 5 5 5 5 4 5 5 3 1 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	9	To be able to	calculate radia	ative heat tran	sfer rates for b	olack bodies or	gray bodies	
Heat conduction equation and Initial and Boundary conditions Heat transfer with one-dimensional conduction in steady state Heat transfer with two-dimensional conduction in steady state Numerical methods in heat conduction Time dependent heat conduction Fundamentals of transport, velocity and thermal boundary layers, dimensionless numbers Midterm Internal and external flow in forced transportation Heat pipes and heat exchangers Internal and external flow in forced transportation Blackbody radiation, Stefan-Boltzmann law Radiation heat transfer between black and gray surfaces and its applications Applications in heat transfer by radiation Final exam Contribution of Learning Outcomes to Program Objectives (1-5) P1 P2 P3 P4 P5 P6 P7 1 5 5 4 5 5 3 1 2 5 5 5 4 5 5 3 1 3 5 5 5 4 5 5 3 1 4 5 5 5 3 1 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Weekly Conter	nt						
Heat transfer with one-dimensional conduction in steady state Heat transfer with two-dimensional conduction in steady state Numerical methods in heat conduction Time dependent heat conduction Fundamentals of transport, velocity and thermal boundary layers, dimensionless numbers Midterm Internal and external flow in forced transportation Heat pipes and heat exchangers Heat pipes and heat exchangers Blackbody radiation, Stefan-Boltzmann law Radiation heat transfer between black and gray surfaces and its applications Applications in heat transfer by radiation Final exam Contribution of Learning Outcomes to Program Objectives (1-5) P1 P2 P3 P4 P5 P6 P7 1 5 5 5 4 5 5 3 1 2 5 5 5 4 5 5 3 1 3 5 5 5 4 5 5 5 3 1 4 5 5 5 3 1 5 5 5 4 5 5 5 3 1 6 5 5 5 4 5 5 5 3 1 7 7 5 5 5 4 5 5 5 3 1 8 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	1	Basic mechar	nisms of heat t	ransfer, definit	ions			
Heat transfer with two-dimensional conduction in steady state	2	Heat conduct	tion equation a	and Initial and	Boundary cond	ditions		
5 Numerical methods in heat conduction 6 Time dependent heat conduction 7 Fundamentals of transport, velocity and thermal boundary layers, dimensionless numbers 8 Midterm 9 Internal and external flow in forced transportation 10 Heat pipes and heat exchangers 11 Fundamentals of heat transfer by radiation 12 Blackbody radiation, Stefan-Boltzmann law 13 Radiation heat transfer between black and gray surfaces and its applications 14 Applications in heat transfer by radiation 15 Final exam Contribution of Learning Outcomes to Program Objectives (1-5) V P1 P2 P3 P4 P5 P6 P7 1 5 5 4 5 5 3 1 2 5 5 4 5 5 3 1 3 5 5 4 5 5 3 1 4 5 5 4 5 5 3 1	3	Heat transfer	r with one-dim	ensional condu	uction in stead	y state		
Time dependent heat conduction	4	Heat transfer	r with two-dim	ensional condu	uction in stead	y state		
7 Fundamentals of transport, velocity and thermal boundary layers, dimensionless numbers 8 Midterm 9 Internal and external flow in forced transportation 10 Heat pipes and heat exchangers 11 Fundamentals of heat transfer by radiation 12 Blackbody radiation, Stefan-Boltzmann law 13 Radiation heat transfer between black and gray surfaces and its applications 14 Applications in heat transfer by radiation 15 Final exam Contribution of Learning Outcomes to Program Objectives (1-5) 2 P1 P2 P3 P4 P5 P6 P7 1 5 5 4 5 5 3 1 2 5 4 5 5 3 1 3 5 5 4 5 5 3 1 4 5 5 3 1 3 1 4 5 5 3 1 4 5 5 4 5 5 <	5	Numerical m	ethods in heat	conduction				
Note	6	Time dependent heat conduction						
9	7	Fundamentals of transport, velocity and thermal boundary layers, dimensionless numbers						
10 Heat pipes and heat exchangers 11 Fundamentals of heat transfer by radiation 12 Blackbody radiation, Stefan-Boltzmann law 13 Radiation heat transfer between black and gray surfaces and its applications 14 Applications in heat transfer by radiation 15 Final exam Contribution of Learning Outcomes to Program Objectives (1-5) P1 P2 P3 P4 P5 P6 P7 1 5 5 4 5 5 3 1 2 5 5 4 5 5 3 1 3 5 5 4 5 5 3 1 4 5 5 5 3 1 5 5 5 4 5 5 3 1 4 5 5 5 3 1 5 5 5 4 5 5 5 3 1 6 5 5 5 4 5 5 5 3 1 7 5 5 5 4 5 5 5 3 1 8 5 5 5 4 5 5 5 3 1 8 5 5 5 4 5 5 5 3 1 9 5 5 5 5 5 5 5 5 5 5 5 3 1 1 8 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	8	Midterm						
Fundamentals of heat transfer by radiation 12 Blackbody radiation, Stefan-Boltzmann law 13 Radiation heat transfer between black and gray surfaces and its applications 14 Applications in heat transfer by radiation 15 Final exam Contribution of Learning Outcomes to Program Objectives (1-5) P1 P2 P3 P4 P5 P6 P7 1 5 5 4 5 5 3 1 2 5 5 4 5 5 3 1 2 5 5 4 5 5 3 1 3 5 5 4 5 5 3 1 4 5 5 4 5 5 3 1 4 5 5 3 1	9	Internal and external flow in forced transportation						
12 Blackbody radiation, Stefan-Boltzmann law 13 Radiation heat transfer between black and gray surfaces and its applications 14 Applications in heat transfer by radiation 15 Final exam Contribution of Learning Outcomes to Program Objectives (1-5) P1 P2 P3 P4 P5 P6 P7 1 5 5 5 9 9 P9 P9 <th colspan<="" th=""><th>10</th><th colspan="4">Heat pipes and heat exchangers</th></th>	<th>10</th> <th colspan="4">Heat pipes and heat exchangers</th>	10	Heat pipes and heat exchangers					
Table 13 Radiation heat transfer between black and gray surfaces and its applications 14 Applications in heat transfer by radiation 15 Final exam Contribution of Learning Outcomes to Program Objectives (1-5) P1 P2 P3 P4 P5 P6 P7 1 5 5 9 9 P4 P5 P6 P7 1 5 5 3 1 Contribution of Learning Outcomes to Program Objectives (1-5) 1 5 P4 P5 P6 P7 1 5 5 3 1 1 2 5 3 1 2 5 3 1 4 5 5 3 <th< th=""><th>11</th><th colspan="4">Fundamentals of heat transfer by radiation</th></th<>	11	Fundamentals of heat transfer by radiation						
14 Applications in heat transfer by radiation 15 Final exam Contribution of Learning Outcomes to Program Objectives (1-5) P1 P2 P3 P4 P5 P6 P7 1 5 5 4 5 5 3 1 2 5 5 4 5 5 3 1 3 5 5 4 5 5 3 1 4 5 5 4 5 5 3 1 5 5 5 4 5 5 3 1 6 5 5 4 5 5 3 1 7 5 5 4 5 5 3 1 8 5 5 4 5 5 3 1 9 5 5 4 5 5 3 1	12	Blackbody radiation, Stefan-Boltzmann law						
15 Final exam Contribution of Learning Outcomes to Program Objectives (1-5) P1 P2 P3 P4 P5 P6 P7 1 5 5 4 5 5 3 1 2 5 5 5 4 5 5 3 1 3 5 5 5 4 5 5 3 1 4 5 5 5 3 1 5 5 5 4 5 5 3 1 5 5 5 4 5 5 3 1 6 5 5 5 4 5 5 3 1 7 5 5 5 4 5 5 3 1 7 5 5 5 4 5 5 3 1 8 5 5 5 4 5 5 3 1 9 5 5 5 4 5 5 3 1	13	Radiation heat transfer between black and gray surfaces and its applications						
Contribution of Learning Outcomes to Program Objectives (1-5) P1 P2 P3 P4 P5 P6 P7 1 5 5 4 5 5 3 1 2 5 5 4 5 5 3 1 3 5 5 4 5 5 3 1 4 5 5 5 3 1 4 5 5 5 3 1 5 5 4 5 5 5 3 1 5 5 5 4 5 5 5 3 1 5 5 5 4 5 5 5 3 1 6 5 5 5 4 5 5 5 3 1 7 5 5 5 4 5 5 5 3 1 8 5 5 5 4 5 5 5 3 1 9 5 5 5 4 5 5 5 3 1	14	Applications	Applications in heat transfer by radiation					
P1 P2 P3 P4 P5 P6 P7 1 5 5 4 5 5 3 1 2 5 5 4 5 5 3 1 3 5 5 4 5 5 3 1 4 5 5 4 5 5 3 1 5 5 4 5 5 3 1 6 5 5 4 5 5 3 1 7 5 5 4 5 5 3 1 8 5 5 4 5 5 3 1 9 5 5 4 5 5 3 1	15	Final exam						
1 5 5 4 5 5 3 1 2 5 5 4 5 5 3 1 3 5 5 4 5 5 3 1 4 5 5 4 5 5 3 1 5 5 5 4 5 5 3 1 6 5 5 4 5 5 3 1 7 5 5 4 5 5 3 1 8 5 5 4 5 5 3 1 9 5 5 4 5 5 3 1	Contribution of Learning Outcomes to Program Objectives (1-5)							
2 5 5 4 5 5 3 1 3 5 5 4 5 5 3 1 4 5 5 4 5 5 3 1 5 5 5 4 5 5 3 1 6 5 5 4 5 5 3 1 7 5 5 4 5 5 3 1 8 5 5 4 5 5 3 1 9 5 5 4 5 5 3 1		P1	P2	Р3	P4	P5	P6	P7
3 5 5 4 5 5 3 1 4 5 5 4 5 5 3 1 5 5 5 4 5 5 3 1 6 5 5 4 5 5 3 1 7 5 5 4 5 5 3 1 8 5 5 4 5 5 3 1 9 5 5 4 5 5 3 1	1	5	5	4	5	5	3	1
4 5 5 4 5 5 3 1 5 5 5 4 5 5 3 1 6 5 5 4 5 5 3 1 7 5 5 4 5 5 3 1 8 5 5 4 5 5 3 1 9 5 5 4 5 5 3 1	2	5	5	4	5	5	3	1
5 5 5 4 5 5 3 1 6 5 5 4 5 5 3 1 7 5 5 4 5 5 3 1 8 5 5 4 5 5 3 1 9 5 5 4 5 5 3 1	3	5	5	4	5	5	3	1
6 5 5 4 5 5 3 1 7 5 5 4 5 5 3 1 8 5 5 4 5 5 3 1 9 5 5 4 5 5 3 1	4	5	5	4	5	5	3	1
7 5 5 4 5 5 3 1 8 5 5 4 5 5 3 1 9 5 5 4 5 5 3 1	5	5	5	4	5	5	3	1
8 5 5 4 5 5 3 1 9 5 5 4 5 5 3 1	6	5	5	4	5	5	3	1
9 5 5 4 5 5 3 1	7	5	5	4	5	5	3	1
	8	5	5	4	5	5	3	1
Contribution Level 1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High								
	Contribution Lev	/el	1: Low 2: Low-in	termediate 3: Ir	ntermediate 4: I	High 5: Very High		

P1 Working with modern scientific sources.

P2 Having modern scientific knowledge and scientific analysis abilities and being able to apply them to scientific problems.

P3 Having theoretical and practical skills in the area of Energy Science and Technology.



DEPARTMENT OF ENERGY SCIENCE AND TECHNOLOGY COURSE SYLLABUS

P4 Having foreign language skills to follow the worldwide advancements in the field of Energy Science and Technology and to be able to discuss them with foreign colleagues.

P5 Having computational skills for research data analysis purposes.

P6 Having appropriate skills for academic and industrial jobs, being ready to take responsibility in working life.

P7 Having knowledge about work occupational work and safety.

Compiled by:	Res Asst. Elvan Burcu Kosma
Date of Compilation:	15.05.2023