AYDIN ADNAN MENDERES UNIVERSITY
COURSE INFORMATION FORM

Course Title	Advance Heat Transfer								
Course Code	GMP528		Couse Level	Second Cycle (Master's Degree)					
ECTS Credit	8	Workload	200 *(Hours)*	Theory	3	Practice	0	Laboratory	0
Objectives of the Course	The objective of the course is to provide students learn to derive the general energy equation in different geometry and the unsteady state heat conduction equation in one direction and multi-dimensional systems; to learn analytical solution methods and Laplace transformation method of this equation; to give applications of unsteady state heat transfer in the food industry and knowledge and calculation methods about freezing, thawing, pasteurization and sterilization.								
Course Content	The energy equation in infinite slab, infinite cylinder and sphere. Heat conduction with internal heat generation Unsteady state heat conduction in solids. Analytical solutions for infinite slab, infinite cylinder and sphere, Freezing and thawing of food materials. Pasteurization and Sterilization Applications. Aseptic Canning Process								
Work Placement	N/A								
Planned Learning Activities and Teaching Methods	Explanation (Presentation), Discussion, Case Study, Individual Study, Problem Solving								
Name of Lecturer(s)									

Assessment Methods and Criteria		
Method	Quantity	Percentage (%)
Midterm Examination	1	30
Final Examination	1	45
Assignment	7	10
Term Assignment	1	15

Recommended or Required Reading	
1	Bird R.B., Stewart W.E., Lightfoot E.N.,1960. “Transport Phenomena”. John Wiley & Sons,Inc.
2	Charm S.E., 1978. “The Fundementals of Food Engineering”. 3rd Ed. AVI Publishing Company,Inc
3	Özilgen, M.1998. “Food Process Modeling and Control. Chemical Engineering Applications” Gordon and Breach Science Publishers
4	Tosun, İ.2002. “Modelling in Transport Phenomena. A Conceptual Approach” Elsevier Science B.V.

Week	Weekly Detailed Course Contents	
1	Theoretical	The energy equation in curvilinear coordinates
2	Theoretical	The equations of motion for forced and free convection in nonisothermal flow. Special cases of the equation of energy change. Uses of equation of energy change. Heat conduction with internal heat generation
3	Theoretical	Unsteady state heat conduction in solids. Analytical solution methods for the equation: combination of variables
4	Theoretical	Unsteady state heat conduction in solids. Analytical solution methods for the equation: separation of variables
5	Theoretical	Unsteady state heat conduction in solids. Analytical solution methods for the equation: Laplace transformation
6	Theoretical	Unsteady state heat conduction in one direction, Analytical solutions for infinite slab, infinite cylinder and sphere, Average values
7	Theoretical	Unsteady state heat conduction in two and three dimensional systems, Unsteady state heat conduction in irregular solids
8	Intermediate Exam	Midterm
9	Theoretical	Freezing and thawing of food materials. Prediction of freezing times of foods. Plank equation
10	Theoretical	Plank equation and modifications, Prediction of freezing times for regular multi-dimensional shapes
11	Theoretical	Prediction of freezing times for irregular shapes
12	Theoretical	Pasteurization and Sterilization Applications. Commerciall Sterility. Sterilization under variant temperature
13	Theoretical	Calculation procedure for sterilizaton at conductive and convective heating conditions. Ball and Olson Method

14	Final Exam	Final Exam

Workload Calculation				
Activity	Quantity	Preparation	Duration	Total Workload
Lecture - Theory	14	6	3	126
Assignment	7	3	0	21
Term Project	1	10	3	13
Midterm Examination	1	17	3	20
Final Examination	1	17	3	20
			Total Workload (Hours)	200
			[Total Workload (Hours) / 25*] = **ECTS**	8
**25 hour workload is accepted as 1 ECTS*				

Learning Outcomes	
1	
2	
3	
4	
5	
6	
7	

Programme Outcomes *(Food Engineering Master)*	
1	To provide further training and research opportunities to food engineers to meet the needs of the food industry
2	To develop and deepen the current and advanced knowledge in the field of food engineering with original thought and / or research at the level of expertise, based on the qualifications of the master
3	To identify, define, formulate and solve problems in applications related to Food Engineering and gain the ability to select and apply appropriate analytical methods and modeling techniques
4	To gain the ability to evaluate the accuracy of the data obtained from food analysis
5	To educate students having research, entrepreneur qualifications

Contribution of Learning Outcomes to Programme Outcomes *1:Very Low, 2:Low, 3:Medium, 4:High, 5:Very High*

	L1	L2	L3	L4	L5	L6	L7
P1	5			3			
P2	5		3				
P3	5	4	5	5	3	5	5
P4	1						
P5					4		