

Course Name						
METAL CASTING AND TECHNOLOGIES						
Code	Semester	Local Credits	ECTS Credits	Course Implementation, Hours/Week		
				Theoretical	Tutorial	Laboratory
MET459E	7	2	3	2	0	0
Department/Program		Metallurgical and Materials Engineering				
Course Type		Elective		Course Language		English
Course Prerequisites		None				
Course Category by Content, %	Basic Sciences		Engineering Science		Engineering Design	General Education
			50%		50%	
Course Description	Liquid metal, nucleation. Solidification of alloy and growth. Solidification of polyphase alloy. Solidification and solidification rate of a real casting. Gate and gating calculation in casting. Feeder, feeding and filling time. Fluidity, gas in liquid metal. Sand mould materials, their properties and related tests. Cores and core production methods. Shell moulds, precision casting, pressure casting. Induction, arc furnaces and their working techniques. Production and casting of grey, tempered, spherical graphite cast iron. Casting of Non-ferrous alloys.					
Course Objectives	The aim of this is to provide an introduction to the basic concepts and the principle of casting described in the course contents: To teach the solidification of liquid metal and nucleation (heterogen and homogeneous nucleation), to introduce the gate and gating calculation in casting. To teach feeding and filling time, to understand the fluidity, gas in liquid metal. To teach the cores and core production methods. Different casting methods such as shell moulds, precision casting, pressure casting. To instruct the different furnace types and their working techniques. To teach production of casting of grey, tempered, spherical graphite cast iron. To introduce casting of non-ferrous alloys.					
Course Learning Outcomes	<ol style="list-style-type: none"> 1. To understand the solidification of liquid metal and nucleation (heterogen and homogeneous nucleation). 2. To learn the gate and gating calculation in casting. Feeding and filling time. 3. To understand the fluidity, gas in liquid metal. 4. To understand the cores and core production methods. Different casting methods such as shell moulds, precision casting, pressure casting. 5. To learn the different furnace types and their working techniques. 6. To learn production of casting of grey, tempered, spherical graphite cast iron. Casting of non-ferrous alloys (aluminium, copper, zinc, magnesium). 					
Textbook	<ul style="list-style-type: none"> - Casting Design and Performance, ASM; Publication Date: 2009 - ASM Handbook Volume 15: Casting, Publisher: ASM; Publication Date: 1988. - Castings practice: the 10 rules of castings, John Campbell, Amsterdam ; Boston, Elsevier/Butterworth-Heinemann, 2004. - Döküm teknolojisi / Ergin N. Çavuşoğlu, İstanbul : İTÜ, 1992. 					
Other References	<ul style="list-style-type: none"> - Casting Design Handbook, American Society For Metals, Metals Park : Reinhold Pub. Corp., 1962. - Basic principles of gating, Reading, Mass. : Addison-Wesley Publishing Co., [1967]. - Materials processing at casting / Hasse Fredriksson, Ulla Akerlind, Hoboken, NJ : Wiley, c2006. 					
Homework & Projects	This is an optional project related with the principles of the metal casting topics.					
Laboratory Work						
Computer Use						
Other Activities						
Assessment Criteria	Activities			Quantity	Effects on Grading, %	
	Midterm Exams			MIN 1	50	
	Quizzes					
	Homework					
	Projects					
	Term Paper/Projec			MAX 1	-	
	Laboratory Work					
Other Activities						
Final Exam			1	50		

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Liquid metal, nucleation. Solidification of alloy and growth	I
2	Solidification of polyphase alloy.	I
3	Solidification and solidification rate of a real casting.	I
4	Solidification and solidification rate of a real casting	II
5	Gate and gating calculation in casting.	II
6	Feeder, feeding and filling time. Fluidity, gas in liquid metal.	II
7	Fluidity, gas in liquid metal.	III
8	Sand mould materials, their properties and related tests.	III
9	Cores and core production methods.	IV
10	Shell moulds, precision casting, pressure casting	IV
11	Shell moulds, precision casting, pressure casting.	V
12	Induction, arc furnaces and their working techniques.	V
13	Production and casting of grey, tempered, spherical graphite cast iron	VI
14	Casting of Non-ferrous alloys (Aluminum, Copper, Zinc, Magnesium).	VI

Relationship between the Course and Metallurgical and Materials Engineering Curriculum

	Program Outcomes	Level of Contribution		
		1	2	3
1	Ability to apply the knowledge of mathematics, science and engineering principles to solve problems in metallurgical and materials engineering (ABET:a)			X
2	Ability to characterize materials using standard and/or self designed experimental methods and to evaluate the results (ABET:b)	X		
3	Ability to design a system or a process, taking into consideration of the desired specifications, quality, ethics and environment. (ABET:c)			
4	Ability to communicate both orally and in the written form and to take part in, and provide leadership of the teams in the elucidation of engineering problems; (ABET:d, g)			
5	Ability to define, formulate and solve engineering problems in the development, production, processing, protection and usage of engineering materials. (ABET:e)			X
6	An understanding of professional and ethical responsibilities(ABET:f)			
7	An understanding of current/contemporary issues and impact of engineering solutions in broad cultural, national and global levels;. (ABET:h, j)		X	
8	A comprehension of the nature of engineering progress closely linked with the development of new materials and production processes. An ability to engage in life-long learning and a recognition of its necessity (ABET:i)			
9	Ability to use essential tools and techniques of modern engineering in the development, production, processing, protecting of the existing and new engineering materials. (ABET:k)		X	

1: Little, 2. Partial, 3. Full

Course relationships with major elements of the field and material classes

		Level of Contribution		
		1	2	3
MAJOR ELEMENT OF THE FIELDS	STRUCTURE			X
	PROPERTIES			X
	DESIGN EXPERIMENT/ANALYSE DATA	X		
	PROCESSING		X	
	COST/PERFORMANCE		X	
	QUALITY/ENVIRONMENT		X	
	DESIGN PROCESS OR PRODUCT			X
MATERIAL CLASSES	METAL			X
	CERAMICS	X		
	POLYMERS	X		
	COMPOSITES	X		

1: Little, 2. Partial, 3. Full

Prepared by	Date	Signature
Assoc. Prof. Dr. Necip Ünlü	December 2020	