Course Name						
PRINCIPLES OF SURFACE TREATMENT						
Code	**Semester**	**Local Credits**	**ECTS Credits)**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 464E	8	2	3	2	-	-

Department/Program	Metallurgical and Materials Engineering Department		
Course Type	Elective	**Course Language**	English
Course Prerequisites	None		

Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
		20	80	

Course Description	Application of surface treatment techniques imparts new and different engineering properties to the surfaces without changing the bulk properties of the materials. Presently, applications of these techniques are becoming widespread and rapidly developing. Surface treatments change the decorative, wear, corrosion resistance of the surfaces and also give new optical, electronic, and magnetic properties to the surfaces. This course aims to educate the students on the principles and the application of surface treatments, giving emphasis to the most widely used surface treatments that are conducted from the solution state.
Course Objectives	After completing this course the student will be able to: 1. Know the importance and the necessity of surface treatment 2. Know the presence of various types of surface treatments 3. Understand the necessity of learning basic principles of surface treatment for selection and application for engineering applications 4. Recommend surface treatments for specific applications such as corrosion protection, wear, decorative 5. Interrelate coating structure and composition with properties and performance
Course Learning Outcomes	1. Student will learn the importance and applicability of surface treatments in solving different engineering problems and recommend suitable the surface treatment technique. 2. Student will learn the methods for structural and compositional characterization of coatings and interrelate them with performance and properties. 3. He will learn to cooperate with other people to attack and solve problem and will also learn how to present his solution.
Textbook	• N. Kanani, Electroplating, Basic principals, Processes and Practice. Elsevier Advanced Technology, Oxford UK, 2004. ISBN 1856174514
Other References	• D. R. Gabe, Principles of Metal Surface Treatment and Protection, 3rd edn., Merlin Books Ltd., Braunton, Devon, 1993 ISBN 0-863030-652-x • R. B. Heimann, “Plasma Spray Coating”, VCH Pub. Weinheim, Germany, 1996 • M. Ohring, “The Materials Science of Thin Films”Academic Press Inc. London U.K., 1992 • W.G. Wood (coordinator), Metals Handbook, 9th Edition, “surface Cleaning, Finishing, ND Coating”, American Society for Metals
Homework & Projects	
Laboratory Work	
Computer Use	
Other Activities	

Assessment Criteria		**Quantity**	**Effects on Grading, %**
	Activities	**-**	**-**
	Midterm Exams	**MIN. 1**	**25**
	Quizzes		
	Homework	**-**	**-**
	Projects	**-**	**-**
	Term Paper/Project	**-**	**25**
	Laboratory Work	**-**	**-**
	Other Activities	**-**	**-**
	Final Exam	**1**	**50**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Definition and classification of surface treatments	1,3
2	Coating from gaseous state:- Physical and chemical vapour deposition and their plasma assisted versions	1
3	Coatings from molten and semi-molten state:- thermal, plasma spray, HVOF and detonation gun, hot dip coatings,	1
4	Coatings from solution state:- chemical coatings, electrochemical coatings, conversion coatings, sol-gel coatings.	1
5	Electrodeposition:- electroplating electrolytes, electroless deposition electrolytes.	1
6	Processes for the deposition of metallic coatings:- Electroless metal, alloy, composite deposition. Distribution of coating thickness.	1,2
7	Processes for electrolytic metal deposition:- DC electroplating, Pulse electroplating, Laser assisted electroplating.	1,2
8	Electrodeposition at the atomistic level:- Structure of metal ions, structure of the double layer, rate determining steps in electrode reactions	1,2
9	Elecrocrystallization:- Nucleation and growth of nuclei. In situ observation of electrodeposition.	1,2
10	Anodic oxidation:- Anodization processes for aluminium and titanium, anodic oxide templates for nano-bio technological applications.	1
11	Conversion coatings:- Chromating and alternatives to chromating, phosphating. New methods of conversion coatings	1
12	Sol-gel coatings:- types of sol-gel coatings. Application areas of sol-gel coatings	1,2
13	Coating characterization:- Adhesion, thickness, hardness, chemistry and composition determination methods	2
14	Project presentation	2,3

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)			X
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			
	COMPOSITES		x	

1: Little, 2. Partial, 3. Full

Prepared by	**Date**	**Signature**
Prof. Dr. Mustafa Ürgen Prof. Dr. M. Kürşat Kazmanlı	December 2020	