

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					
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 principles, Processes and Practice. Elsevier Advanced Technology, Oxford UK, 2004. ISBN 1856174514					
Other References	1. D. R. Gabe, Principles of Metal Surface Treatment and Protection, 3rd edn., Merlin Books Ltd., Braunton, Devon, 1993 ISBN 0-863030-652-x 2. R. B. Heimann, "Plasma Spray Coating", VCH Pub. Weinheim, Germany, 1996 3. M. Ohring, "The Materials Science of Thin Films" Academic Press Inc. London U.K., 1992 4. 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	Activities	Quantity		Effects on Grading, %		
	Midterm Exams					
	Quizzes	MIN. 1		25		
	Homework					
	Projects					
	Term Paper/Project	1		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 electrolyte	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	Electrocrystallization: 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

	Student Outcomes	Level of Contribution		
		1	2	3
1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering science and mathematics		X	
2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare as well as global, cultural, social, environmental and economic factors			
3	an ability to communicate effectively with a range of audiences			X
4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts		X	
5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives			X
6	an ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgement to draw conclusions			
7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies			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			
	PROCESSING			X
	COST/PERFORMANCE	X		
	QUALITY/ENVIRONMENT	X		
	DESIGN PROCESS OR PRODUCT		X	
MATERIAL CLASSES	METAL			X
	CERAMICS AND GLASS	X		
	POLYMER			
	COMPOSITES		X	
	BIOMATERIALS			

1: Little, 2: Partial, 3: Full

Prepared by Prof. Dr. M. Kürşat KAZMANLI Assist. Prof. Dr. Cem Örneç	Date December 2021	Revision #	Signature
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