

Course Name						
DESIGN PRINCIPLES&MATERIALS SELECTION FOR ENGINEERING APPLICATIONS						
Code	Semester	Local Credits	ECTS Credits	Course Implementation, Hours/Week		
				Theoretical	Tutorial	Laboratory
MET 353E	5	1.5	3	1	1	-
Department/Program		Metallurgical and Materials Engineering				
Course Type		Required		Course Language		English
Course Prerequisites		None				
Course Category by Content, %		Basic Sciences	Engineering Science	Engineering Design	General Education	
		-	30	50	20	
Course Description		<p>This course provides an introduction to the methodology of materials and process selection with respect to a set of performances. The focus is essentially on materials properties but the course also addresses issues related to processing and process related properties gained.</p> <p>And in the course design principles for a required set of performances will be given and case studies will be examined. Students' team projects will include design and materials/process selection for required set of dependent parameters.</p>				
Course Objectives		<ol style="list-style-type: none"> 1.Recognize and determine lists of independent and dependent parameters for a design. 2.Differentiate the difference between product design and process design. 3.Describe, both conceptually and analytically, how system components work. 4.To built a bridge between other courses taught up to date to recognize and understand scientific engineering principles behind materials /processes which are designed in light of materials/processes performances. 5.Participate in an integrated design activity in light of consumer expectations. 6.Demonstrate the knowledge of product design process using the tools of design for manufacturability and assembly, robust design, quality function deployment, concurrent engineering, cost evaluation and decision making 7.Selection of materials and optimization of behavior by using a systematic methodology which combines materials properties with the engineering function of the process or product design. 8.To defend materials selection effectively both orally and in written form. 9.To select and use appropriate industrial literature and library resources in the solution of material selection and failure analysis problems. 				
Course Learning Outcomes		<p>Students who pass the course will have a knowledge on</p> <ol style="list-style-type: none"> 1.Engineering materials, design concept and they will differentiate the independent and dependant parameters which influence the performance of process and product design, 2.The application of the knowledge learned on a design of a product and/or process. 3.Recognizing the scientific idea behind designing new materials or processes 4.Utilizing material/process selection charts and select materials/processes 5.Recognizing the role of design and quality tools and utilizing them in their designs. 				
Textbook		<ol style="list-style-type: none"> 1.Materials Selection in Mechanical Design, Fourth Edition <i>Michael F. Ashby</i> , 2011, <i>Elsevier</i>, ISBN 978-1-85617-663-7 2.Integrated Product and Process Design and Development: The Product Realization Process, Second Edition Edward B. Magrab, University of Maryland, College Park, Maryland, USA; Satyandra Gupta, University of Maryland, College Park, USA; F. Patrick McCluskey, University of Maryland, College Park, USA; Peter Sandborn, University of Maryland, College Park, USA, 2010, CRC Press ISBN: 9781420070606, 				
Other References		<ol style="list-style-type: none"> 1.DIETER, GEORGE E.,Engineering Design: A Materials and Processing Approach,Third Edition. McGraw-Hill 2000, 2.PAHL, GERHARD, AND WOLFGANG BEITZ,Engineering Design: A Systematic Approach,Second Edition. Springer-Verlag, 1996, 3.OTTO, KEVIN AND KRISTIN WOOD,Product Design: Techniques in Reverse Engineering and New Product Development,Prentice-Hall 2001, ULRICH, KARL T., AND STEVEN D. EPPINGER,Product Design and Development,Second Edition. McGraw-Hill, 2000, Tenth Edition. McGraw-Hill, 1996, 				
Homework & Projects		<p>Team work projects:</p> <ol style="list-style-type: none"> 1.To find examples of big bad designs due to inappropriate materials/process selection and write a report and a short oral presentation. 2. Design and materials/process selection project: identifying the factors which influence selection, collection of further data/information relevant to the problem, use of information on books, patents, software or etc. for structuring and interrogating data. <p>Projects include a technical report, and a short presentation.</p>				
Laboratory Work						
Computer Use		MICROSOFT PROJECT, VISIO				
Other Activities		-				
Assessment Criteria)		Activities		Quantity	Effects on Grading, %	
		Midterm Exams		1	20	
		Quizzes				
		Homework				
		Projects		2	30	
		Term Paper/Project		1	40	
		Laboratory Work				
Other Activities		1	10			
Final Exam						

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Evolution of engineering materials, Product Development at The Beginning Of The Twenty-first Century	1
2	Design Concept, Design Process, types of design and design tools and materials data The Integrated Product And Process Design And Development Team Method	2
3	Product Cost Analysis, Translating Customer Requirements Into A Product Design Specification, Product Functional Requirements And Functional Decomposition Product Concepts And Embodiments	2,3
4	Short team work presentations on bad designs due to in appropriate materials and process selection	2,3
5	Engineering Materials and their properties, Materials Property Charts	1,4
6	Material Selection, Materials Property Charts	4,5
7	Manufacturing Processes Design and Selection	4,5
8	Case Studies	
9	Multiple Constraints and conflicting objectives	3,4
10	Case Studies	
11	Case Studies	
12	Designing Hybrid Materials	2,3,4
13	Materials and Environment	2,4
14	Teamwork presentations	

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			X
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 judgments, 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, analyze and interpret data, and use engineering judgment to draw conclusions		X	
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	X		
	PROCESSING			X
	COST/PERFORMANCE			X
	QUALITY/ENVIRONMENT			X
	DESIGN PROCESS OR PRODUCT			X
MATERIAL CLASSES	METAL		X	
	CERAMICS AND GLASS		X	
	POLYMERS		X	
	COMPOSITES		X	
	BIOMATERIALS	X		

1: Little, 2. Partial, 3. Full

Prepared by Prof. Dr. Özgül Keleş	Date December 2020	Revision #	Signature
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