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	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. 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.
Course Objectives	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	Students who pass the course will have a knowledge on 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	Materials Selection in Mechanical Design, Fourth Edition *Michael F. Ashby , 2011, Elsevier, ISBN 978-1-85617-663-7* 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	DIETER, GEORGE E.,Engineering Design: A Materials and Processing Approach,Third Edition. McGraw-Hill 2000, PAHL, GERHARD, AND WOLFGANG BEITZ,Engineering Design: A Systematic Approach,Second Edition. Springer-Verlag, 1996, 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	**Team work projects:** 1.To find examples of big bad designs due to inappropriate materials/process selection and write a report and an 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. Projects include a technical report, and a short presentation.
Laboratory Work	
Computer Use	- **MICROSOFT PROJECT, VISIO**
Other Activities	**-** **-**

Assessment Criteria)	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterm Exams	**1**	**20**
	Quizzes	**-**	
	Homework		
	Projects	**2**	**35**
	Term Paper/Project	**1**	**45**
	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	I
2	Design Concept, Design Process, types of design and design tools and materials data The Integrated Product And Process Design And Development Team Method	II
3	Product Cost Analysis, Translating Customer Requirements Into A Product Design Specification, Product Functional Requirements And Functional Decomposition Product Concepts And Embodiments	II, III
4	Short team work presentations on bad designs due to in appropriate materials and process selection	II, III
5	Engineering Materials and their properties, Materials Property Charts	I, IV
6	Material Selection, Materials Property Charts	IV, V
7	Manufaturing Processes Design and Selection	IV, V
8	Case Studies:	
9	Multiple Constraints and conflicting objectives	III, IV
10	Case Studies	
11	Case Studies	
12	Designing Hybrid Materials	II, III, IV
13	Materials and Environment	II, IV
14	Teamwork presentations	

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)			**X**
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)			**X**
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)	**X**		
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		**X**	
	COMPOSITES		**X**	

1: Little, 2. Partial, 3. Full

Prepared by	**Date**	**Signature**
Prof. Dr. Özgül Keleş	December 2020	