Course Name						
INTRODUCTION to BIOMATERIALS						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 328E	6	2	4	2	-	-

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**
	-	20	60	20

Course Description	A general introduction to biomaterials science, definition and performance of biomaterials, an emphasizing the importance of materials science, basic classification of materials, atomic structure and bonding, bond types, crystal and amorphous structures, classifications of materials used in medicine (metallic, ceramic and polymeric biomaterials, composites as biomaterials), some background concepts (biocompatibility, stress shielding, tissue-implant interactions, structure-property relationships of biological materials), soft and hard tissue replacements, tissue response to implants, host reactions to biomaterials and their evaluation, testing of biomaterials (in-vivo and in-vitro assessments), tissue engineering materials and regeneration, characterization of biomaterials
Course Objectives	1.To improve students analytical thinking by focusing structure-property- process relations of biomaterials 2.Learning basic biomaterials science knowledge and based on this infrastructure recognizing the current biomaterials and their basic production routes, understanding their microstructure and performance relations, selection and safety criteria and related engineering standards 3.To encourage students to understand and experience disciplinary engineering in problem solving
Course Learning Outcomes	The student will 1.Understand structure-property-process relations in in biomaterials 2. Describe atomic bonds, orders, crystallography and the effects of bonding in biomaterials 3. Classify and select biomaterials and processes 4. Learn the tissue response to implants 5. Explain soft and hard tissue replacements 6. Learn tissue engineering applications and materials 7. Understand the concepts of biological materials 8. Understand the concepts of in-vivo and in-vitro test 9. Learn the applications of materials in medicine and dentistry
Textbook	B.D. Ratner, S.A. Hoffman, F.J. Schoen, J.E. Lemons, “Biomaterials Science: An Introduction to Materials in Medicine”, Elsevier Academic Press, 2004, ISBN: 0125824637
Other References	1. Askeland, D.R., “The Science and Engineering of Materials”, Chapman & Hall,1993 2. L.L. Hench, J. Wilson, “An Introduction to Bioceramics”, Advanced Series in Ceramics Vol. 1, 2nd Edition, 1999, ISBN: 9810214006. 3. Shackleford, J.F., “Introduction to Materials Science for Engineers”, Prentice-Hill 4. Callister, W.D., “Fundamentals of Materials Science and Engineering: An Integrated Approach”, 2nd Edition, Wiley Pub. 5. Ashby, M., Shercliff, H., Cebon, D., “Materials: Engineering, Science, Processing and Design”
Homework & Projects	Student groups (with 6-7 members) prepare a report by choosing one of the 20-25 different topics given.
Laboratory Work	-
Computer Use	-
Other Activities	-

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterm Exams	**1**	**35**
	Quizzes		**-**
	Homework		
	Projects		
	Term Paper/Project	**1**	**25**
	Laboratory Work		
	Other Activities		
	Final Exam	**1**	**40**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Introduction to biomaterials science and structure of solids	1,2
2	Some background concepts, protein, cell, types of tissue	1,3
3	Metallic biomaterials	3,4,5
4	Ceramic biomaterials	3,4,5
5	Ceramic biomaterials, dense and porous hydroxyapatite	3,4,5
6	Polymeric biomaterials	5,6
7	Composite biomaterials	5,6
8	Biological biomaterials	6,7
9	Soft and hard tissue replacements, hip joint prosthesis fixation: problems and possible solutions	5,8
10	Orthopedic and dental applications	5,9
11	Radiotherapy glasses and clinical applications	9
12	Artificial organs	9
13	Nano biomaterials and biosensors	8,9
14	Preservation techniques for biomaterials	8,9

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			
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			
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			
6	an ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgement 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			
	PROCESSING		X	
	COST/PERFORMANCE			
	QUALITY/ENVIRONMENT			
	DESIGN PROCESS OR PRODUCT			X
MATERIAL CLASSES	METAL			X
	CERAMICS AND GLASS			X
	POLYMER			X
	COMPOSITES			X
	BIOMATERIALS			X

1: Little, 2: Partial, 3: Full

Prepared by	Date	Revision #	Signature
Prof. Dr. Gültekin GÖLLER Assoc. Prof. Dr. İpek AKIN KARADAYI	December 2020		