COURSE INFORMATON					
Course Title	***Code***	***Semester***	***L+P Hour***	***Credits***	***ECTS***
Micro-Nano Biomaterials in Biomedical Engineering	**BME530**		(3+0+0)	3	10

Prerequisites	Biomaterials

Language of Instruction	English
Course Level	Master's Degree
Course Type	Technical Elective
Course Coordinator	Prof. Dr. Ali Ümit Keskin
Instructors	Assist. Prof. Feride Şermin UTKU
Assistants	
Goals	To provide biomedical engineering students knowledge on conventional and developing micro-nanomaterials, technologies and applications.
Content	Micro-nanoscale materials used in biomedical engineering; including self-assembled protein-based structures and polymers, biomimetic/bio-inspired synthetic materials, carbon nanotubes, shape-memory alloys and super elastic materials, single crystal deposition by cells, bottom-up construction of biomaterials, interfacial adhesion under wet and dry conditions, processing and micro/nanostructure to mechanical, electrical, optical, and magnetic characterization of advanced ceramics, composites and hybrid materials at different length scales, as well as materials used in applications such as regenerative medicine, tissue engineering to cancer therapy.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Knowledge of basics of material science, biocompatibility and the chemistry of biomaterials.	2,4,5,6,7,11	1,2,3	A,C,D
2) hierarchical biological materials, structure-function relations.	2,4,5,6,7,11	1,2,3	A,C,D
3) techniques of biomaterial production	2,4,5,6,7,11	1,2,3,9	A,C,D
4) analysis and characterization of biomaterials	2,4,5,6,7,11	1,2,3,12	A,B,C,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project Presentation

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Basics of material science and biocompatibility	Lecture Notes, Articles
2	Hierarchical biologic materials, structure-function relationı	Lecture Notes, Articles
3	Micro-nanomaterials used in biomedical engineering	Lecture Notes, Articles
4	Self-assembled protein-based structures and polymers	Lecture Notes, Articles
5	Biomimetic/bio-inspired synthetic materials	Lecture Notes, Articles
6	Carbon nanotubes	Lecture Notes, Articles
7	MID-TERM	Lecture Notes, Articles
8	Shape-memory alloys and super elastic materials	Lecture Notes, Articles
9	Single crystal deposition by cells	Lecture Notes, Articles
10	Bottom-up construction of biomaterials	Lecture Notes, Articles
11	Interfacial adhesion under wet and dry conditions	Lecture Notes, Articles
12	Advanced ceramics, composites and hybrid materials	Lecture Notes, Articles
13	Processing and structural, mechanical, electrical, optical, and magnetic characterization of materials at different length scales	Lecture Notes, Articles
14	Materials used in regenerative medicine, tissue engineering and cancer therapy	Lecture Notes, Articles

RECOMMENDED SOURCES	
Textbook	
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	50
Homework	10	20
Presentation	1	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

	COURSE'S CONTRIBUTION TO PROGRAM						
No	**Program Learning Outcomes**	**Contribution**					
		0	**1**	**2**	**3**	**4**	**5**
1	Ability to reach wide and deep knowledge through scientific research in the field of Biomedical Engineering, evaluate, interpret and apply.					**X**	
2	Ability to use scientific methods to cover and apply limited or missing knowledge, and to integrate the knowledge of different disciplines to identify, define, formulate solutions to complex engineering problems.				**X**		
3	Ability to construct Biomedical Engineering problems, develop methods to solve the problems and use innovative methods in the solution.				**X**		
4	Ability to develop new and/or original ideas, tools and algorithms; develop innovative solutions in the design of system, component or process.					**X**	
5	Ability to have extensive knowledge about current techniques and methods applied in Biomedical Engineering and their constraints.				**X**		
6	Ability to design and implement analytical modeling and experimental research, solve and interpret complex situations encountered in the process.					**X**	
7	Ability to use a foreign language (English) at least at the level of European Language Portfolio B2 in verbal and written communication.					**X**	
8	Ability to lead in multidisciplinary teams, develop solutions to complex situations and take responsibility.				**X**		
9	Ability to pass process and the results in Biomedical Engineering field, in national and international area in or outside of the field, systematically and clearly in written or oral form.				**X**		

10	Awareness of the social, legal, ethical and moral values and environmental dimensions. The ability to conduct research and implementation work within the framework of these values.				**X**		
11	Awareness of the new and emerging applications in Biomedical Engineering field, and the ability to examine them and learn if necessary.					**X**	
12	Ability to read, understand, present, critise research work and conduct original theoretical or applied research.				**X**		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	**Quantity**	**Duration (Hour)**	**Total Workload (Hour)**
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	3	36
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Midterm examination	2	3	6
Homework	5	6	30
Presentation	1	20	20
Final examination	1	3	3
Total Work Load			240
Total Work Load / 25 (h)			9.6
ECTS Credit of the Course			**10**