COURSE INFORMATON					
Course Title	**Code**	**Semester**	**T+P+L Hour**	**Credits**	**ECTS**
BIOMIMETIC METHODS IN BIOMINERALIZATION	BME 533	1	3+0+3	3	10

Prerequisites	-

Language of Instruction	English
Course Level	Master's Degree
Course Type	Restrictive Elective
Course Coordinator	
Instructors	Dr. F. Şermin UTKU
Assistants	
Goals	This course aims to provide information about biomineralization and to discuss and perform biomimetic methods of biomineralization.
Content	This course will discuss the general concepts of biomineralization, types of biominerals and their function, formation of bile stones and calsification in cancer, biological induction of biomineralization, crystal nucleation and growth, control of crystal morphology, the biomacromolecule-crystal interface, the inter-, intra, extra- and epicellular biomineralization, organic scaffolds in biomineralization and biomimetic methods in biomineralization using electrochemistry.

Learning Outcomes	**Program Outcomes**	**Teaching Methods**	**Assessment Methods**
6) To define and explain biomineralization and its manifestation in various organisms	1,2,3,5,6,7,8	1,2,3,5,8,15	B,C,D
7) To be informed about natural and biomimetic biomineralization processes	1,2,3,5,6,7,8	1,2,3,5,8,15	B,C,D
8) To learn induction of biomineralization and calcification processes in cancer.	1,2,3,5,6,7,8	1,2,3,5,8,15	B,C,D
9) To understand biomineralization using biomacromolecules.	1,2,3,5,6,7,8	1,2,3,5,8,15	B,C,D
10) To obtain biominerals using biomimetics processes	1,2,3,5,6,7,8	1,2,3,5,8,12,15	B,C,D
Teaching Methods:	: 1: Lecture, 2: Question-Answer, 3: Discussion, 9: Simulation, 12: Case Study: 4: Application, 5: Demonstration, 6: Motivation For Demonstration, 7: Role Playing, 8: Group Study, 9: Simulation, 10: Brain Storming, 11: Case Study, 12: Laboratory/Atellier, 13: Self-Study, 14: Problem Session, 15: Project Based Learning, 16: Undefined		
Assessment Methods:	A: Test, B: Experiment, C: Homework, D: Project/Design, E: Performance, F: Portfolio, G: Undefined		

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction to biomineralization	Books, articles
2	Biominerals and functions	Books, articles
3	Biomineralization characterization	Books, articles
4	Biominerals and tissue and cell interactions	Books, articles
5	Chemical and biological control of biomineralization of hard tissues	Books, articles
6	Bile stones, cancer and calcification	Books, articles
7	Induction of biomineralization	Books, articles
8	Control of crystal morphology using orgagnic scaffolds	Books, articles
9	Biomimetic methods in biomineralization, hydroxyapatite	Books, articles
10	Biomimetic methods in biomineralization, magnetite	Books, articles
11	Biomimetic methods in biomineralization, silica	Books, articles
12	Biomimetic methods in biomineralization, ZnO	Books, articles
13	Student presentations	
14	Student presentations	

RECOMMENDED SOURCES	
Textbook	3) P. M. Dove, J. J. DeYoreo, S. Weiner (Eds.) Biomineralization, Reviews in Mineralogy & Geochemistry Vol. 54, 2003. 4) S. Mann, Biomineralization, Oxford University Press, 2001, Oxford, New York.
Other Sources	1) H. Lowenstam, S. Weiner, On Biomineralization, Oxford University Press, 1989, Oxford. 2) Selected research papers, powerpoint presentations

MATERIAL SHARING	
Documents	Project presentations and current articles.
Assignments	In-class presentation of articles
Exams	Biomineral production using biomimetic methods.

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	0	0
Projects	1	30
Assignment	3	10
Total		60
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		100
Total		100

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	**Program Learning Outcomes**	**Contribution**					
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information to model and solve engineering problems.				**X**	
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modelling methods for this purpose.				**X**	
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.				**X**	
4	Ability to devise, select and use modern techniques and tools needed for engineering practice; to employ information technologies effectively.		**X**			
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					**X**
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.			**X**		
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.			**X**		
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					**X**
9	Awareness of professional and ethical responsibility.	**X**				
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.	**X**				

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	**Quantity**	**Duration (Hour)**	**Total Workload (Hour)**
Course Duration (Including the exam week:	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	7	98
Proje	1	36	36
Homework	3	12	36
Final examination	1	28	28
Total course hours)			240
Total Work Load / 25 (h)			9.6
ECTS Credit of the Course			10